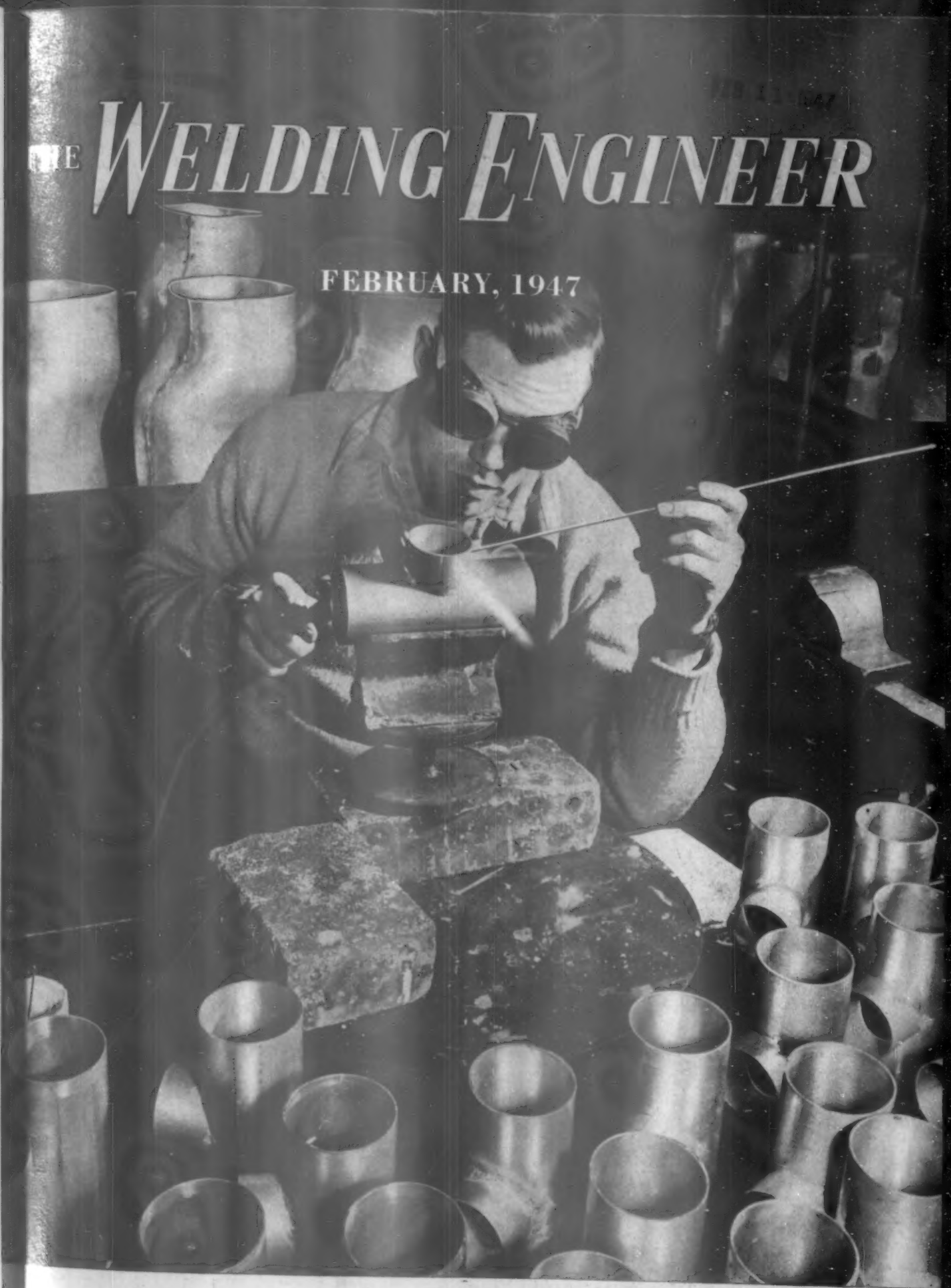
THE WELDING ENGINEER

FEBRUARY, 1947



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2 NEW Jacksons

JH-2

They're *Streamlined*

Compactly built, these new holders are the right tools for working in hard-to-get-at places. They're indispensable for work in narrow corners and may be passed through small openings. Yet, like all Jacksons, they're designed on the long-proven tong-type principle.

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Made of the same light metal alloy which proved so successful in Jackson's line of *Featherlight* holders, these new models reduce operator fatigue to a minimum. As in all *Featherlight* holders, rods are held by replaceable jaws of Mallory 3 metal. Cable connection is made mechanically.

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Give these holders the green light for *safety*. Insulated all around, only the working surface of the jaws is stripped for action, so rods may be changed with a minimum of effort. Yet plenty of ventilation is provided to make these holders work cool under all working conditions.

JH-3

2 Models:

JH-2 takes rods through 5/32"

JH-3 takes rods through 1/4"

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THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

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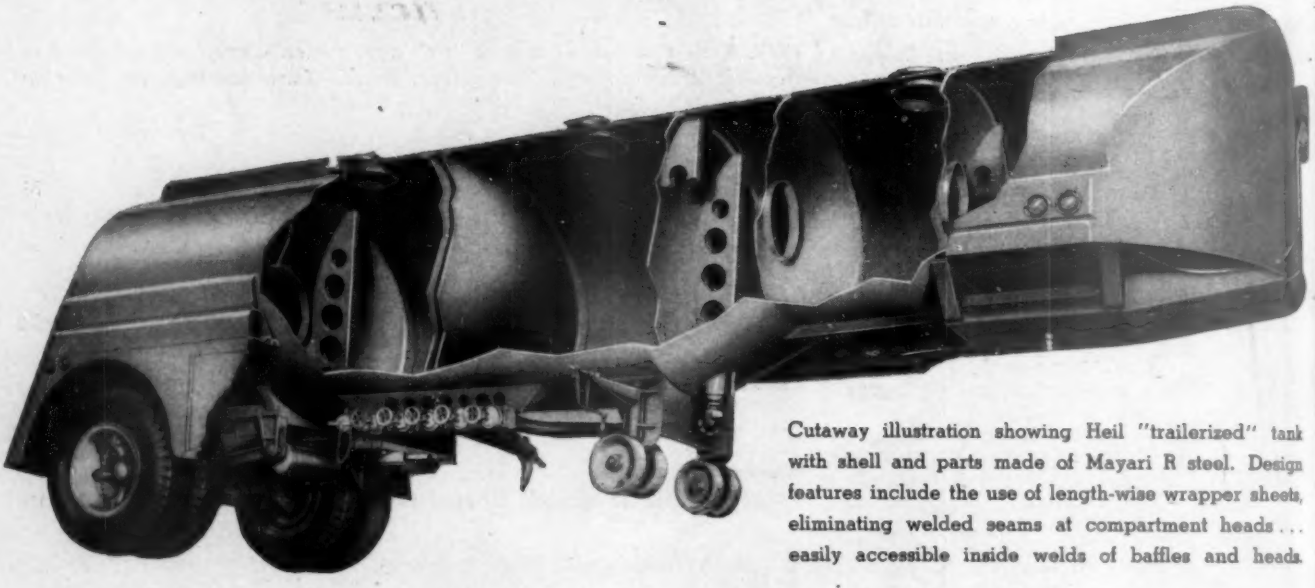
TRAILERIZED TRANSPORT TANKS *Save Deadweight* WITH HIGH-TENSILE STEEL



Cutaway illustration showing Heil "trailerized" tank with shell and parts made of Mayari R steel. Design features include the use of length-wise wrapper sheets, eliminating welded seams at compartment heads . . . easily accessible inside welds of baffles and heads.

The "trailerized" tanks built by the Heil Company are the product of sound engineering combined with modern low-alloy, high-strength steels.

Simplified design of these tankers eliminates the frame and many of the supporting members ordinarily used in trailer tanks. Their tank shells and component parts have strength to carry the full load without the need for additional support.

Heil uses Mayari R for tank shells, baffles and deep-dished heads. This low-alloy, high-strength steel provides adequate strength and at the same time effects a 20 percent saving in deadweight. The weight-saving in turn allows the maximum increase in carrying capacity consistent with commercial regulations.

Builders of many types of trucks, trailers and buses are now using Mayari R to gain latitude in design, increase strength, increase payload capacity and reduce deadweight. Any one or any combination of these advantages can be had with this highly versatile steel.

For full information on the properties of Mayari R and its applications in the automotive field write the nearest Bethlehem office for Catalog 209.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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★ BETHLEHEM STEEL ★

Mayari R *makes it lighter... stronger... longer lasting*

ESTABLISHED 1916 THE WELDING ENGINEER FEBRUARY, 1947

"Prosper Our Beginning"

THE DOLLAR has so deteriorated in buying power during the past 14 years that it is now worth about 31 cents before taxes are deducted. When taxes are taken out, the dollar is worth somewhere between 16 and 20 cents as compared to what it would buy in the early 1930's. There are going to be changes made, however, according to our new Congress. It may soon be that the dollar bill you take out of your wallet will mean more—more in purchasing power, more in the Pursuit of Happiness.

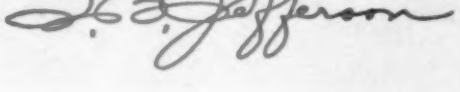
The next time you take a dollar bill out of your wallet, it might be a good idea to look it over with a little attention. How many times does the written or numerical "one" appear on it? Chance are you can't guess the answer within three; count the "ones" and see.

On the back of the bill you will find two circles containing the obverse and reverse of the Great Seal of the United States. The reverse of the seal is especially interesting, and it is rather unfortunate that its symbols are not better understood. First there may be seen an unfinished pyramid of thirteen courses of masonry—the thirteen colonies solidly laid to form the beginnings of the nation. The capstone of the pyramid floats above in glory, bearing the all-seeing eye symbolic of divine blessing and watchfulness. The seal is completed by two Latin mottoes. The motto above may be translated as "Prosper Our Beginning"; the one beneath means, "A New Order of the Ages."

This is essentially the seal as it was adopted by our forefathers in 1782. It was thus that they thought of this nation—perfectly designed, with a broad, strongly built base, but yet to be completed. Completion was to be in accordance with the master plan of the people of this country. How wise that master plan is and how much of our present happiness we owe to it may be realized when we contemplate the bleak outlook faced by the inhabitants of many nations in the world today. For these poor souls, the future holds little; they can live only in dread of the next desperate expedient.

A vision not yet fulfilled; a country not yet completed! A firm foundation with upward-aspiring lives converging on the Highest—this is the message that is written on the symbols appearing on our most common piece of paper currency. To those who have faith in our destiny, it is a message of courage. It means that America will live and justify all of our beliefs, all of our labors for freedom and justice.

A dollar bill is passed from hand to hand in countless daily transactions. If the true meaning of its message were better understood, we believe that these constant reminders would make for a better America.



How a Thermit Weld is Made

Thermit welding was introduced more than 40 years ago. Now an accepted process—it is regarded as the standard method of joining very heavy sections and of welding rail on street railway systems. The Thermit process differs from other fusion welding methods in that it deposits in bulk—all at one time—a quantity of molten metal sufficient to complete the weld. This weld metal—known as Thermit steel—can be produced in varying compositions, making it possible—in most instances—to match the chemical and physical properties of the parts to be joined.

Thermit welding is made available in three ways: (1) it may be done by your own crew in your plant after instruction by one of our engineers; (2) parts can be shipped to us; or (3) we can do the work in your plant.

Contact our nearest office today and get the complete story on this time-and-expense-saving process. Metal & Thermit Corporation, 120 Broadway, New York 5, N. Y., Albany, Chicago, Pittsburgh, So. San Francisco, Toronto.

MAKING THE WELD

1. A mold box of sufficient size is constructed around the section to be welded. (The size of a Thermit weld is governed only by the limitations of mold construction.)

2. The parts to be welded are pre-heated to a red heat. During pre-heating a crucible is placed in position and filled with the desired Thermit mixture.

3. The mixture is ignited and the Thermit reaction takes place. In Fig. A, the reaction has occurred and the crucible is ready for tapping.

4. In Fig. B, the crucible is tapped, allowing the Thermit steel to fill the mold completely—thus preventing oxidation.

5. The pre-heated metal fuses with the fluid metal, Fig. C. Cooling takes place at a uniform rate throughout with only one shrinkage. Hence, serious internal stresses are eliminated.

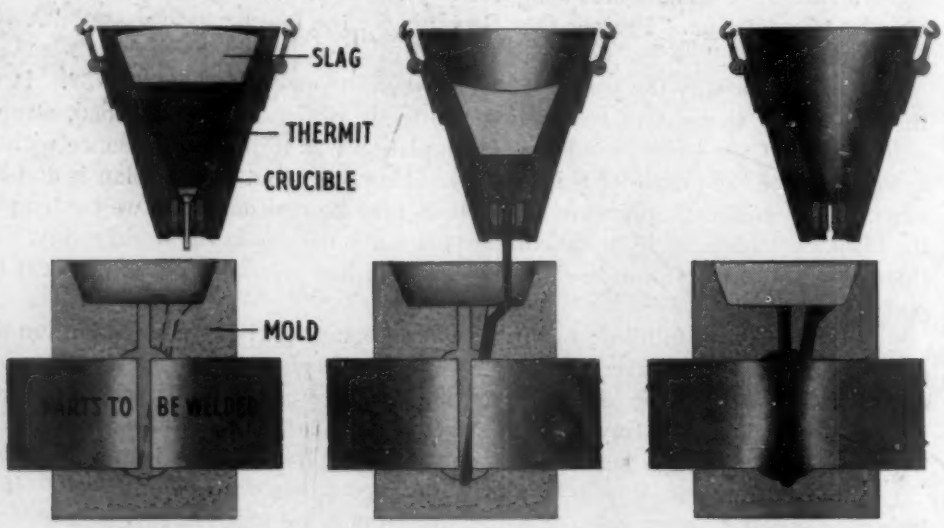


Fig. A Fig. B Fig. C

THERMIT WELDING

Welding Builds Stainless-Steel KETTLES

Here Weldor James Lavelle lays a bead on the inside seam of a 500-gallon. Note the ring fixture on which the kettle is resting.

Fig. 5

A background of 50 years in the business has given Groen Manufacturing the know-how and know-why. Welding is indispensable to the production of these fine kettles.

BY CLYDE B. CLASON

"HALF a century of fine kettles" is the slogan of the Groen Manufacturing Co., Chicago. To this we might add that the phrase, "Groen or equal," is becoming rather common in specifications for commercial cooking kettles.

Groen makes welded stainless-steel kettles—big ones—for all types of food processing. Most of them are steam-jacketed types in which the food is cooked by live steam introduced between the inner and outer walls. Thousands of Groen steam-jacketed kettles are serving in the kitchens of hotels, restaurants, cafes, hospitals and other institutions throughout the country. Other thousands have been purchased by the Army, the Navy and other branches of the U. S. government.

Originally a coppersmithy with a long tradition of quality behind it, Groen turned in 1930 to the fabrication of stainless steel. Today 95% of its output is in that material. Vessels of copper, nickel, Monel,

★ PRODUCTION

Everdur and aluminum will be made on special orders, but all of the standard types of kettles described in the Groen catalog are of bright and shining stainless.

For the purpose of cooking food in a sanitary and hygienic manner, stainless is virtually ideal. It resists the corrosive effects of the various organic acids found in foods, imparts no metallic contamination, preserves the original taste and purity of even the most delicate flavors. Stainless is also strong and tough. Because of its density and hardness, it defies long usage and wear. Once it has been highly polished, it will retain its lustrous surface almost indefinitely. For these and similar reasons, stainless-steel equipment is widely used by canning plants, beverage brewers, dairies and packing houses. No other material could possibly serve as well for commercial cooking, the Groen management is convinced.

The Groen line includes a steam-jacketed industrial cooking kettle in capacities of from 20 to 500 gallons, a similar kettle supplied with a hinged cover and a shallow covered kettle that is used largely as a meat roasting kettle in hospitals and other institutions. These three types are very similar in design. All of them are mounted upon legs (there are both three and four legged types) and equipped with steam inlets, outlets and safety valves.

Another type of steam-jacketed kettle is mounted upon trunnions and fitted with a trigger-operated tilting device and a large spout for pouring. This tilting kettle is used to cook and handle preserves, pie fillings and similar heavy, viscous liquids. Still another type is mounted upon a pedestal and equipped with what is known as a "tangent drawoff," an outlet directly tangent to the streamlined bottom.

The kettles described above are all intended to use steam delivered at specified temperatures and pressures from a central system. Groen also makes kettles that generate their own steam, both by electric and by gas heating. Their cooking action is the same as that of the kettles to be attached to a steam line.

Groen steam-jacketed coffee urns are offered in capacities of from 20 to 150 gallons. If desired, these may be furnished with a repouring device.

Finally, the company manufactures special types of mixer and agitator models for use by food processers, chemical plants, packers, drug manufacturers, etc. These are equipped with motor-driven agitators and various types of scraping blades. The latest addition to the Groen line—so new that it is not yet listed in the catalog—is a coating pan, a giant bowl of a shape very like that of certain Indian pottery. It is not turned out on the potter's lathe, however, but by forming and welding six separate sections—five segments plus a bottom.

Why Welding Is Used

Welding is indispensable to the manufacture of all of the products described in the paragraphs above. As compared with one-piece construction by deep drawing, welded fabrication offers the three big advantages of speed, economy and quality. A large kettle can be formed in segments and welded together far more rapidly than it can be deep drawn in one piece from steel or aluminum, and the waste of material is not nearly so great. Deep drawing is also apt to result in a shell of varying thickness with areas of thinner metal known to the kettle trade as "hot spots." Because of the absence of hot spots in Groen weld-fabricated kettles, cooking is uniform throughout the entire surface of the jacket.

Groen weldors are experts in the making of pressuretight seams. Of the thousands of stainless-steel steam-jacketed kettles built by this company, not one has ever blown up or suffered damage due to its own failure. Leaks are virtually impossible, and a time measured in decades of years is needed for the appreciable corrosion of stainless steel.

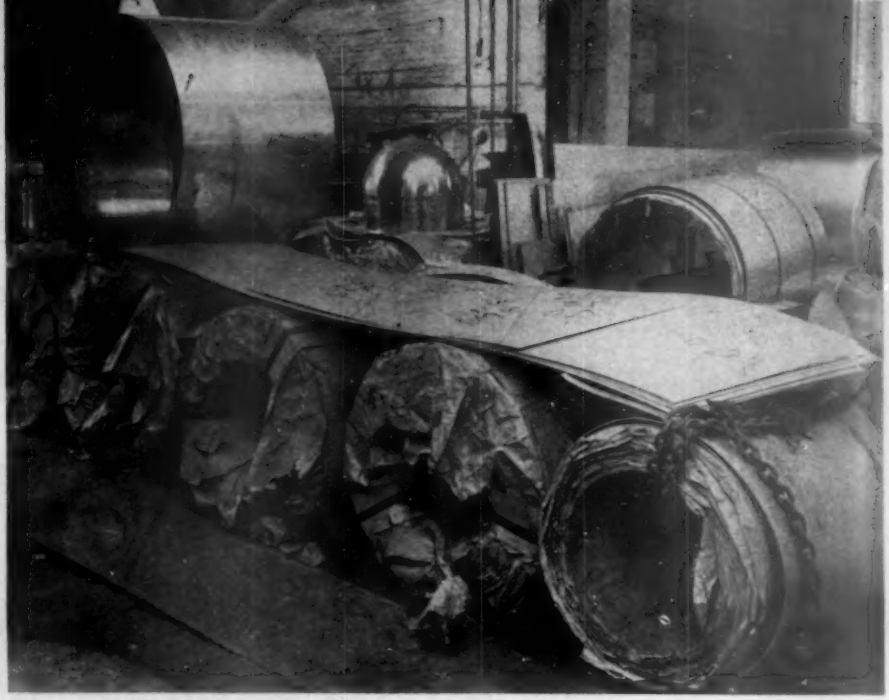


Fig. 1—Coils of sheet stock waiting to be made into kettles. The triangular segments are marked for the 25-OD jacket of a 30-gallon kettle

In order to examine the production set-up in detail, let us follow the manufacture of one typical product, say a model N-80. This is an 80-gallon steam-jacketed industrial kettle which may be used for meats, vegetables, fruits or all general cooking purposes. It measures 32 in. in diameter by 29 in. deep and stands approximately 49½ in. high upon its three tripod-mounted legs. It has a threaded outlet pipe 1½ in. in diameter, a 1-in. steam inlet connection and a safety valve. A cover is not standard equipment but may be added if the customer wishes. The weight, crated, of this particular kettle is 225 lb.

Brothers and sisters of the N-80 range from a little fellow 20 in. in diameter to a giant measuring 60 in. across by 54 in. deep and holding 500 gallons. All of them are fabricated by means of welding.

The manufacturing process begins with flat sheets of steel—for the N-line of kettles 18-8 stainless in thicknesses of from 16 to 10 gauge. This material is delivered from the mill in large coils, which are unrolled and cut as needed. For special jobs, the company may use plates of 3/16, ¼ or even ⅜ in. thickness, and such plate must be delivered flat and cut to standard mill sizes. It is a great deal more economical to utilize the coils, which produce almost no scrap except for the short pieces left over at the ends.

The sheet stock is marked in triangular segments with a marking pencil as shown in Fig. 1. The OD of the particular kettle and the job number are also lettered on each segment. The triangles marked in Fig. 1 are for the 25-in. diameter jacket of a 30-gallon kettle.

Perhaps at this point a word or two should be said about the shape of the N-80 and its smaller and bigger brothers. Imagine a hemisphere with a squat cylinder welded above it, and you will have the proper picture of the inside portion. The jacket is simply another hemisphere without the upper rim. Both inner and outer hemispheres are made by welding together four segments assembled in orange-peel fashion.

The segments must first be formed. This is done cold on a punch press (Fig. 2) fitted with upper and lower forming dies. A great many impressions are necessary to shape one segment, and the work calls for a high degree of judgment, skill and craftsmanship on the part of the operator. From one to two operators are required, depending on the size of the piece, and the dies must be changed at least once during the forming of each segment.

This method of cold forming preserves the gauge thickness of

Fig. 2—This operator is forming a segment for an 80-gallon kettle of 32-in. ID. The work is done cold

Fig. 3—The formed segments are sheared to exact dimensions. This segment is for an 80-gallon kettle

the steel and does not change its physical properties as hot working might do. The segments are literally beaten into their proper shapes, and they are, if anything, strengthened by the operation.

After forming, the edges must be trimmed so that the segment will line up with its fellows in the proper hemispherical contour. The segment is marked to dimensions and sheared on the machine shown in Fig. 3. Torch cutting has never been tried at Groen because of the inherent difficulties in the flame-cutting of stainless steel. Possibly the newly developed flux-cutting processes (see page 66), might render the operation feasible.

Assembly by Tack Welding

Edge beveling is not necessary to prepare the segments of the 80-gallon kettle for welding, though it is for the segments of large-diameter kettles. A portable hand grinder does the beveling swiftly and efficiently. The four segments for the 80-gallon model are assembled on a table and tacked as shown in Fig. 4. No jig is needed; a helper merely holds the curved pieces together while the weldor tacks them into place. The sheets have been so trimmed that a hole is left in the bottom of the hemisphere. This will serve eventually for the outlet pipe, and in the meantime it is useful in many production operations.

The tacked assembly is delivered to another department for finish welding. Starting from the bottom opening, one bead is deposited on the inside and the outside of each seam. Virtually all of this welding is done in the down-hand position. This is made possible by two simple fixtures, designed and made in the shop under the supervision of Ben Lasky, foreman of welding and polishing. Mr. Lasky, a veteran of 15 years with Groen, knows all the tricks of his trade and these two positioning fixtures are among the neatest of them.

To weld the inside seam, the kettle is laid upon the ring fixture shown in Fig. 5 (headpiece) and moved to whatever position is desired. This fixture is the height of simplicity; it consists merely of a ring formed of bar stock welded to three short angle irons which serve as legs. The kettle is easily shifted upon this ring, though to move the larger sizes may require the aid of a block-and-tackle. The 60-in.-diameter bowl shown in Fig. 5 weighs in the neighborhood of 400 lb, so the reason is clear why the block-and-tackle is necessary.

Another type of fixture, basically different in design, is used when the outside seams are to be welded.

Fig. 4—Tack welding the four segments that make up the inner bowl of an 80-gallon kettle. One man holds while another man welds

Fig. 6—Welding the outside seam of a 60-gallon kettle. Ben Lasky, foreman of welding and polishing, is inspecting the operation. Note the special fixture

Fig. 7—Making the circumferential weld that joins the foot-high rim to the bowl of a 200-gallon, 48-in. ID kettle. Rollers position the assembly for downhand welding

Fig 8—Fitting on the jacket of an 80-gallon kettle. Live steam will be introduced between the inner and outer walls for cooking.

This is shown in Fig. 6. It consists essentially of a base, a piece of piping that turns in bearings about a horizontal axis and a pipe of smaller diameter that telescopes inside the first pipe. A flat disc with a short and still smaller piece of piping welded to one side and a threaded stud affixed at the center of the opposite side completes the fixture.

The disc is placed over the telescoping pipe with its stud-side uppermost. The short welded tube fits snugly within the pipe to hold the disc in place. The kettle is now rested upon the disc with the threaded stud protruding through the bottom hole previously referred to. A nut is then screwed down to secure the weldment. The kettle can be raised or lowered to any desired height by means of the telescoping pipe and locked there. The outer pipe can then be tilted upward or downward through 90 degrees and locked into position.

This method of positioning is wholly satisfactory for kettles up to about 40 in. in diameter. Larger ones must be suspended from the block-and-tackle and hoisted into the required positions for welding the outer seams.

Use Type 304 Electrodes

Welding electrodes of type 304 stainless are used in diameters of $\frac{3}{32}$, $\frac{1}{8}$ and $\frac{5}{32}$ in. These electrodes have a composition of 19% chromium and 9% nickel (an analysis slightly richer in alloys than the base metal) and a lime-based coating. This type of electrode must be used on direct current, reverse polarity (electrode positive). The deposited metal is resistant to oxidizing acids, oils and certain chemicals and has a fair resistance to oxidation and to creep at moderately elevated temperatures. It has a tensile strength as welded of 80,000 psi and 40% elongation.

Once the proper technique has been mastered, it is not much more difficult to weld stainless than to weld mild-steel sheets, asserts Foreman Ben Lasky. Because the weld metal flows more readily than mild steel, a greater forward motion with less sidewise motion is required for each weave. In downhand welding, the electrode is held vertically or very slightly tilted in the direction of travel and must be so manipulated as to give a clean, uniform pool of molten metal at all times. The rear of the pool should solidify at a regularly progressing rate as the electrode advances.

Fig. 9—Polishing the inside of a 500-gallon kettle. The kettle is being spun at the same time to bring its shape to perfect geometric regularity

Not too much metal should be deposited at any one time. The practice at Groen is to lay a bead about 6 in. long and then pause to knock off the slag with a weld-cleaning tool before continuing to weld. A heavy slag is produced by the electrode coating. The weldor holds a short arc—just long enough to keep the electrode coating from touching the molten pool. The welding heat is somewhat less than that which would be used with mild-steel electrodes of equivalent diameters, as too high a current would cause the core wire to become red hot and produce a wild arc, heavy spatter and undercutting. Recommended current ranges and voltages are:

$\frac{3}{32}$ in.: 45–70 amp, 25 volts
$\frac{1}{8}$ in.: 70–110 amp, 28 volts
$\frac{5}{32}$ in.: 100–150 amp, 28 volts

No special precautions to overcome distortion are taken at Groen. The seams are welded consecutively, starting always at the bottom and working to the top. If distortion occurs, it will be hammered out by a vigorous peening after all of the welding has been completed. Stress-relieving heat treatment is not recommended for this type of stainless steel, but the peening serves to remove most of the locked-up stresses caused by forming and welding.

With seams welded inside and out, the hemisphere for the inner bowl is taken to another department, where a fitting for the outlet pipe is welded on at the bottom. After this, the shape is completed by adding the cylindrical, unjacketed portion above the hemisphere. The height of this ring of formed sheet steel is approximately

13 in. on a kettle of 32-in. diameter (80-gallon model). The ring terminates at the top in a rolled edge, which is later soldered at the back for the sake of neatness.

The method of welding the rim to the inner bowl is shown in Fig. 7. The tacked assembly is rotated on rollers so that only downhand welds need to be made. The outlet pipe fitting serves as a bearing for a short axle that is fastened to a pedestal-type fixture similar to the one used to weld the outside seams of the hemispheres. The kettle is thus held in position longitudinally but left wholly free to rotate. The circumferential seam, like all of those preceding it, is welded inside and out, one bead being laid on each side.

Adding the Jacket

All of the welded seams are now ground with a portable electric grinder. On the inside of the kettle the welds are ground flush, while on the outside a slight reinforcement is left. The kettle is peened to remove locked-up stresses and is ready to receive its jacket, as shown in Fig. 8.

The jacket is another hemisphere and is fabricated in the same manner as the inner bowl of the kettle. It is made so as to provide space between the inner and outer walls for the cooking steam. This space varies from 2 in. at the bottom to ½ in. at the top of the kettle. Besides the outlet opening at the bottom, the jacket has additional openings for the steam inlet and the safety valve. Another difference from the inner hemisphere is that the seams of the jacket are ground flush on the outside and left unfinished on the inside (where they will not show) to secure maximum strength.

Like the inner hemisphere, the jacket is subjected after fabrication to a severe peening over its entire inner and outer surfaces. This eliminates the locked-up stresses of forming and welding and brings the walls to uniform thickness throughout.

The jacket is welded to the inner basin, using the techniques previously described. The upper seam joining the two components must be pressure-tight and so must be the fillet that surrounds the bottom outlet fitting.

The kettle is now ready to have its interior finished. This is done in two stages. In the first, an operator equipped with a portable grinder carefully goes over every square inch of the inner surface to remove all pits and rough spots. In the second stage, the kettle is placed on rollers and spun while being polished, Fig. 9. This cold spinning not only facilitates polishing but brings the contour to true geometric regularity. Another electric grinder is used with a buffing wheel and a polishing compound to secure a lustrous, satiny finish of almost mirror smoothness. When polishing has been completed, all traces of the welded seams have disappeared, and the kettle appears to be of one-piece construction.

We have already mentioned the rolled edge formed at the top of the upper rim. The back of this edge is now soldered down all the way around, using a composition of 60% lead, 40% tin. The use of a lead solder is permissible because the seam is wholly on the outside, and the solder can never touch the food inside the kettle.

The kettle now receives its first hydrostatic test, Fig. 10. If it is designed to carry a working pressure of 90–100 psi, a testing pressure of 150 psi is applied. While the space between the two walls is filled with water at this pressure, an inspector goes over both inside and outside surfaces with an electric lamp in a painstaking search for tiny telltale beads of moisture. If such a drop is found, he marks the spot with a punch and circles the location with a red crayon. The kettle is then returned to the welding shop. After its leaky spots have been filled in, it is given a second hydrostatic test to check the soundness of the repairs. The outside is then ground and polished.

The next step is to weld on the three or four fittings for the legs, an operation that is usually performed by the night shift. Legs and leg braces are inserted and welded in place. Fittings are also welded on for the safety valve

(*Continued on page 72*)

Fig. 11—With legs and other fittings welded into place, the 80-gallon kettle is ready to be crated for shipment

Fig. 10—An 80-gallon kettle is receiving its first hydrostatic test. A test pressure of 150 psi is applied when the working pressure is to range from 90 to 100 psi

Welded Piles

Mr. Schutz describes a type of steel pile, fabricated by welding H-beams, that should lend much to the future of steel-and-concrete pier construction.

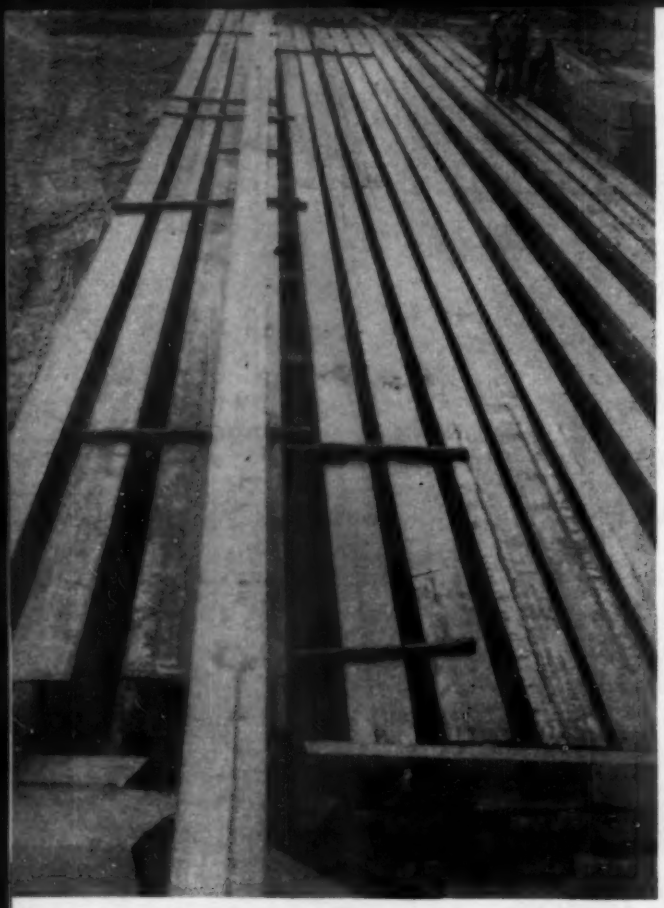


Fig. 1 (above)—Welded 130-ft H-beams on assembly platform in the Jersey City yard of J. Rich Steers, Inc.

Fig. 2 (right)—Projecting lugs welded to the webs of the top sections made for easy alignment. On each web two rods were welded to the unbeveled side and one in the center of the web on the beveled side

CONSTRUCTION of a new steel-and-concrete pier at Edgewater, N. J., required the welding of 14-in., 89-lb H-beams in exceptionally long lengths for use as steel piles. Many of the beams were in 65-ft lengths, and the piles were multiples of 65 ft—130 and 195—except for 330 which were made up of 80-ft lengths.

The pier was built by J. Rich Steers, Inc., for Seatrain, Inc. Many of the piles used in this pier, especially those in lengths up to 120 feet, were prefabricated in a horizontal position in the Steers yard in Jersey City (Fig. 1). They were transported to the pier site by barge.

The first step in the preparation of the beams which were welded into piers was that of preparing the ends for butt welding. This was done by using the flame-cutting torch to bevel the flanges and webs at an angle of 45 deg. The end which was prepared was then butted to the end of an adjacent beam. The end of this adjacent beam was not beveled, but left in the as-cut position after it had been trimmed off square.

The web of each beam was first aligned for both line and grade before welding. After the webs were welded, the beam was turned 90 deg by means of a crane to place the flanges into proper horizontal welding position. Each beam was welded on both sides of each flange as well as on both sides of the web.

USE ¼-IN. ELECTRODES

All welding in the flat position was done with ¼-in. E-6020 electrodes, using a d-c motor-generator set and a welding heat of 300 amp at 40 volts. The welding of the root passes was also accomplished with the same electrodes. Use of the ¼-in. rod for all passes speeded up production considerably and removed the necessity of changing current settings to compensate for changes in electrode sizes.

The final assembly of each pile was done in the field by setting the top section upon the lower section. This placed the weld in a horizontal plane. The field welds were made with $\frac{3}{16}$-in. E-6010 electrodes, using a portable Diesel-driven d-c welder and a welding heat of 175 amp at 40 volts.

The upper sections were guided into proper position by locating bars 1 in. in diameter and 6 in. long. Three bars were welded to the web of each upper beam so that they projected 3 in. beyond the end of the beam. Two bars were welded at the junction of web and flange opposite to the side that was beveled, and the third was welded in the center of the web on the beveled side (see Fig. 2). When the upper section was lowered to the top of the bottom section, the three projecting prongs accurately aligned top and bottom beam both

for a Pier . . .

★ CONSTRUCTION

BY HENRY SCHUTZ, *Welding Superintendent, J. Rich Steers, Inc.*

Fig. 3—This 13-lead pile driver located an entire bent of 13 piles with one setting. The piles were driven in place with a 7-ton hammer having a 2½-ton ram

Fig. 4—Cutoffs from the driven piles. Note the deformations of the piles driven to refusal on the bed rock. About 10 ft per pile were allowed for cutoff

as to web and flanges. The bars were later welded to the lower section after the web and both flanges had been completely welded on both sides.

Drive 13 Piles at Once

A unique feature of this project was the use of a 13-lead pile driver (Fig. 3) that located an entire bent of 13 piles with a single setting. This pile lead was the design of A. C. Elliot, for many years dock builder superintendent for J. Rich Steers, Inc. It permitted the setting up of numerous bottom piles for driving before the top sections were aligned and welded. The leads for all 13 piles were 48 ft in height, and the beams were set into position in the leads with a floating whirley crane having a boom length of 103 ft. This crane could unload a barge loaded with prefabricated 130-ft H-beams directly into the leads.

These plumb piles were driven with a steam hammer having a net weight of 14,000 lb and a ram of 5,000 lb. This hammer is capable of striking a blow of 19,150 ft-lb, 95 strokes a minute. The lengths of the plumb piles ranged from 90 ft inshore to 210 ft outshore.

The batter piles were welded and driven with the use of a batter pile lead that held two piles. These piles were driven with a steam hammer having a weight of 10,000 lb, a ram of 5,000 lb and capable of striking a blow of 15,000 ft-lb, 115 strokes per minute. The length of the batter piles varied from 110 ft inshore to 195 ft outshore.

Piles were driven to practical refusal on bed rock. This resulted in considerable deformation in the tops of some piles and often required the removal of the deformed section by flame-cutting the flanges while the beam was still in the follower under the hammer. About 10 ft per pile were allowed for cutoff (Fig. 4).

Each pile was capped with a 1¼-in. plate having an area of 14 by 16⅝ in. The plate was welded to the top of the pile through two slots cut so as to catch the web.

The welding and driving of 647 of these steel piles embraced a period of five months and required a total of 1,019 welds in prefabrication and field welding. Altogether 8,000 lb of ¼-in E-6020 and 7,500 lb of $^{5}/_{16}$-in. E-6010 electrodes were used in the entire welding program. Despite the unusual stresses developed on the welds during the driving of the piles, there were no failures in any of the welds.

The entire project was under the supervision of W. D. Malcolm, chief engineer, and John Malcolm, general superintendent. Field supervision was under the personal direction of Harold Lehmkuhl, superintendent in charge of construction.

Stresses "frozen" and photographed in a transparent plastic medium provide a perfect analogy with residual stresses in plug welds.

BY JAMES J. RYAN
Associate Professor,
University of Minnesota

★ RESEARCH

Fig. 1—Photoelastic "frozen" stresses with plate around the annealed area at room temperature

Photoelastic Models

THE "frozen" stresses developed in a photoelastic medium are analogous to the residual stresses found in a plate after welding. In both, the maximum residual stresses occur at a given distance outside the weld or indicated weld. The temperature gradient of the plates to be welded, however, is found to control the intensity of the residual stresses.

These are some of the conclusions reached as the result of an investigation of residual weld stresses by the photoelastic method, carried out by the author at the University of Minnesota. The material used was a specially developed Bakelite[1] which has the property of expansion with the temperature and the characteristic of becoming relatively weak at temperatures above 230 F.

By analyzing the visible stresses experimentally developed in the transparent Bakelite, it is possible to determine the location of maximum residual stresses with plug welds and the effects of plate temperatures surrounding the weld. The same method of analysis may easily be extended to linear welds.

To remove or to impress residual stresses in the photoelastic models, the Bakelite material is heated to the annealing temperature. Expansion stresses may be thus set up around a small area which has been locally heated. These stresses are partially released by raising the temperature of the spot above the annealing temperature. As the area is cooled, the contraction of the material in it applies tensile forces to the surrounding area. These "frozen" stresses, when viewed in the polariscope, show the distribution of the residual stresses. An analogous situation is found in the contraction of a plug weld during cooling.

How Tests Were Made

A polished Bakelite sheet, approximately 6 in. wide, 12 in. long and ¼ in. thick, was supported with the long dimension upward. Electric soldering irons were placed against opposite faces of the sheet at the middle of the lower half. The tips of the irons were aluminum cylinders of ½ in. diameter with thermocouple wires inserted near the faces. The temperature cycle consisted of raising the temperature of the tips slowly to approximately 250 F, holding this temperature for an hour and slowly reducing the tips to room temperature—an accelerated procedure for producing "frozen" stresses in Bakelite.

Tests were conducted with three different temperature conditions for the area of the plate immediately surrounding the tips. In the first group of tests, the aluminum tips were wrapped with asbestos and glass wool, and air at room temperature was circulated over the plate. In the second group, dry ice was placed against the plate around the tips to reduce the temperature outside the heated area as low as possible. In the third series coils of heater wire were

[1] *Photoelasticity*, Frocht, John Wiley and Sons, New York, 1941, pp. 329–344.

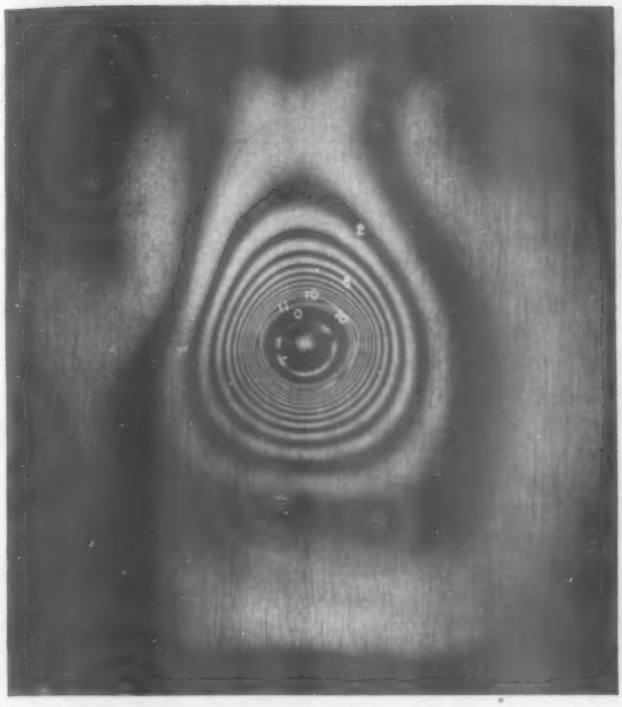


Fig. 2—Photoelastic stresses with plate around the annealed area at extremely low temperature

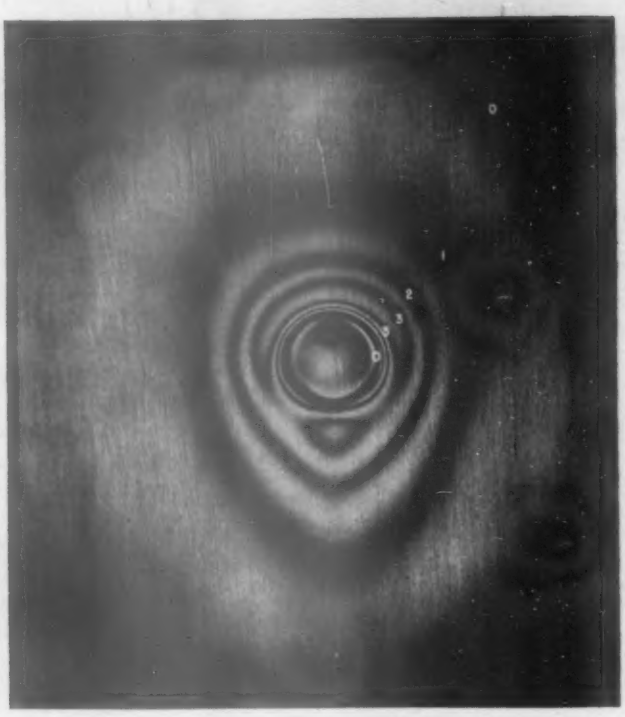


Fig. 3—Photoelelastic stresses with plate around the annealed area subjected to gradient temperature

Reveal Weld Stresses*

spiraled parallel to the plate around uninsulated tips in order to produce a temperature gradient from the tips to the edge of the plate.

Band Count Tells Stresses

Polariscope photographs of the resulting "frozen" stresses for three tests are shown in Figs. 1, 2 and 3. Of greatest importance is the count of the number of photoelastic bands or fringes since the number of bands is proportional to the residual stresses. For the three tests, the numbers are 5½, 11½ and 3½, respectively. The temperature of the ½-in. tips affected the plate for a radius of $^{17}/_{32}$ in. for the first and last tests and $^{7}/_{16}$ in. for the second test. The first and second tests shown were made on opposite halves of the same plate. The stress distribution was not symmetrical due to the rectangular plates used and the uneveness of the temperature distribution over the plate surface.

To obtain a mathematical check of the validity of these tests with respect to stress distribution, the plug weld lends itself to analysis by the theory of elasticity. Considering the plate as a disc of outside radius b, with a hole of radius a, acted upon by an inner tension p at the edge of the hole, the equations for the tangential and radial stress distributions for any radius r are given as follows[2]:

$$P = \frac{-p\,a^2}{b^2 - a^2}\left(1 - \frac{b^2}{r^2}\right)$$

$$Q = \frac{-p\,a^2}{b^2 - a^2}\left(1 + \frac{b^2}{r^2}\right)$$

Since the radial stresses P and the tangential stresses Q are opposite in sign, the difference of the principal stresses (the numerical sum) is taken for comparison with the isochromatic bands shown by the polariscope. The curves shown in Fig. 4 compare the photoelastic stress distribution for the test in Fig. 2 with the theoretical stress calculation of the plug weld; a high degree of similarity between the two curves is indicated.

One factor of importance exhibited by the photoelastic test results was the transition of the stresses from tension and compression in the radial and tangential directions at the edge of the affected area. The maximum difference of the stresses and also the maximum principal stress was observed to occur at a radius 15 to 20% larger than the radius of the affected area. The range was obtained from measurements for several tests. Weld failure would occur at this location.

The effect of the distribution of temperature over the face of the plate around the weld on the residual stresses was particularly pronounced in these tests. With different sizes of annealed areas, the maximum residual stresses were uniformly 5½ to 6 bands for plates maintained at room temperature. For the cold test (with dry ice on

[2] *Theory of Elasticity*, Timoshenko, McGraw-Hill Book Co., New York, 1934, pp. 56–57.

* Abstract of a paper presented at the semi-annual meeting of the American Society of Mechanical Engineers, Detroit, 1946.

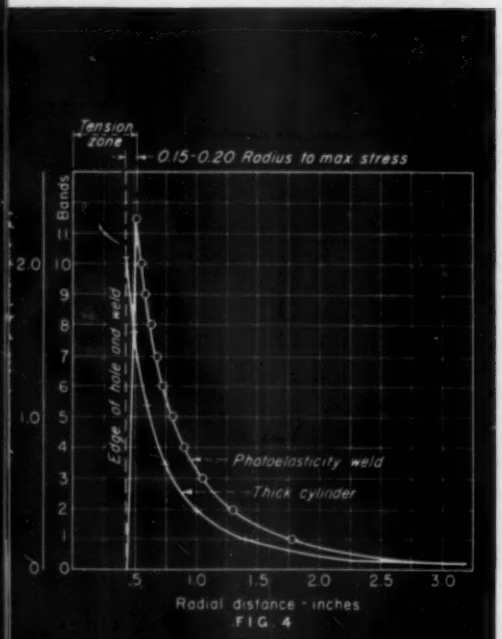


FIG. 4

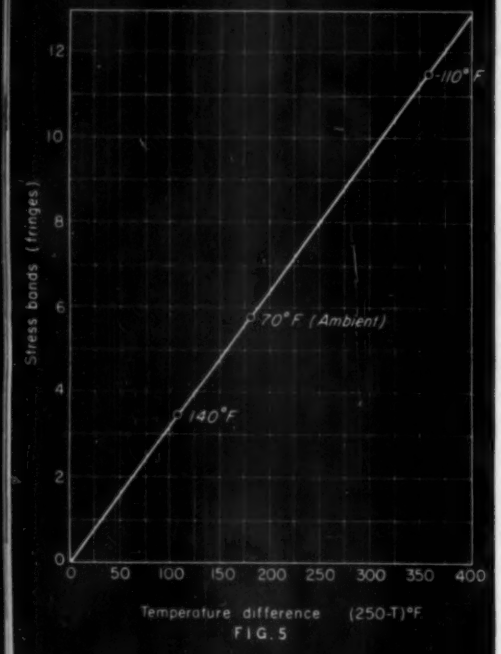


FIG. 5

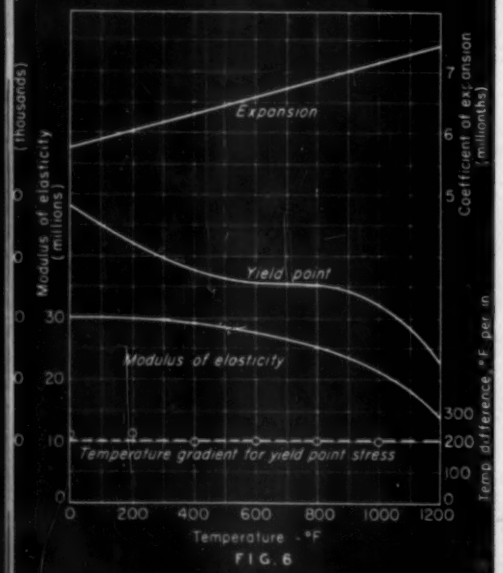


FIG. 6

the plate surfaces) the number of stress bands doubled. The stresses were nearly reduced one half by attempting to produce a heat gradient from the temperature of the hot spot to room temperature in a radial distance of about 3 in. Inadequate control of the temperature gradient for the last test is evident.

The hypothetical chart, Fig. 5, shows the tendency of the effects of temperature distribution around the weld. For the tests shown in Figs. 1, 2 and 3, the approximate temperatures for the area surrounding the weld were 70 F, −110 F and 140 F. Assuming a 250 F temperature in the Bakelite weld, this chart indicates that with the proper temperature gradient emanating from the weld area the residual stresses may be reduced to small values.

A combination of three factors creates the residual stresses observed in these tests for the plug weld: (1) temperature-gradient stresses which produce permanent set due to excessive expansion of the material surrounding the welded area; (2) tensile stresses in the welded area due to contraction of the weld; (3) compressive stresses in the weld which are caused by excessive contraction of the material outside the area. From these tests, it may be observed that permanent set stresses are greatly reduced by control of the temperature gradient around the weld area. The minimum residual stresses depend upon the degree of tension or compression exerted by the surrounding material.

To reduce the residual stresses of a plug weld in steel, the temperature gradient would be controlled so that permanent set is not established due to excessive temperature stresses. For mild-steel structural plates, a temperature gradient up to 200 F per inch will not exceed the elastic limit. This value is obtained by considering the increase in the coefficient of expansion and the decrease in the modulus of elasticity and the yield point with temperature for steel, as shown by the curves in Fig. 6.[1] The proper temperature gradient would materially reduce residual stresses.

Application to Butt Welding

The application of this study to the analogous butt welding of two plates could be accomplished by applying strip heaters about ¼-in. wide across the midsection of a Bakelite plate. After the material under the heaters had been soak-annealed at 250 F for the proper length of time, the heaters would be slowly withdrawn endwise, allowing the material to set or freeze in the uncovered portion. The plate would then contain residual stresses as does a steel plate after welding. The author believes that a gradient of heat applied around the freezing portion as it moves would greatly reduce the residual stresses. From further study, a procedure for the control of residual stresses in welding could probably be developed.

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[1] *Applied Elasticity*, Timoshenko and Lessells, Westinghouse Technical Night School Press, East Pittsburgh, Pa., 1925, p. 384.

Fig. 4—Comparison of photoelastic stress distribution with theoretical stresses in a thick cylinder that is equivalent to a plug weld

Fig. 5—Chart of residual stresses for assumed plate temperature surrounding the annealed area

Fig. 6—Determination of maximum allowable temperature gradient for the welding of structural plates

Courtesy American Manganese Steel Div.

"If I knew she could cook like she can weld, I'd ask her to marry me!"

Fig. 1—Bank of spot welders used for spot tacking the halves of stainless-steel stampings into assemblies for aircraft exhaust systems. The final seam welds will be made by the oxy-acetylene welding process

★ OPERATION

Hitting Trouble Before It's Due

BY C. A. LEHTON AND H. F. WORCESTER
Electrical Maintenance Dept., Ryan Aeronautical Co.

Fig. 2—On stainless-steel tanks, the seam welder is used to produce water-tight seams. Note the printed card giving maintenance instructions

A planned preventive maintenance program has eliminated shutdowns and reduced by one third the costs of keeping welding equipment in order.

For more than three years the Ryan Aeronautical Co., San Diego, Calif., has operated 75 welding machines with virtually no lost machine time. Much of this period the factory was on a three-shift production basis. The machines include 45 arc welders which have operated continuously without any stoppages that interferred with production. Among the 25 spot welders also included there was but one stoppage, due to a burned-out transformer, which necessitated a four-day machine loss

Fig. 3—Spot-welding electrodes are dressed with an emery cloth to restore the proper contour and remove all traces of oil, oxides and dirt

Fig. 5—An oscillograph is used to check timing and current amplitude

because of the difficulty of procuring a replacement.

Credit for this enviable operation record is due to the systematic method by which preventive maintenance is handled in the San Diego plant. The electrical maintenance group is responsible for maintenance of all electrical welding equipment and carries out this job under the direction of Plant Engineering. The watchword of Electrical Maintenance is, "An ounce of prevention is worth a pound of repairs," and this slogan has been thoroughly inculcated. A scheduled program of lubrication, mechanical and electrical work is pursued in connection with electrical equipment. In the case of the 25 spot welders, for instance, a designated group of personnel are assigned under a qualified electrician to maintain these machines.

Most of the spot welders at Ryan are used to produce aircraft manifolds and other formed and welded structures of extremely complex shapes (Fig. 1). Seam welders (Fig. 2) are used on products in which airtight or watertight seams are necessary. Since the various subassemblies into which manifold components are welded must be finished by grinding, all of these welding machines are unavoidably subjected to dust. Many of the maintenance problems encountered are caused by this dust. As might be expected, copper electrodes have to be frequently dressed with emery cloth (Fig. 3) to remove all traces of oil, oxides and dirt which might impede current flow.

Welder Control Maintenance

Particular difficulty is experienced with the delicate control and timing devices, despite the fact that these controls are housed in sealed or filtered cabinets. It is necessary to wipe out the housings with clean rags (Fig. 4) and purge them with blasts of air at least once a week. The heavy load that is imposed on the sequence and timing controls of Ryan spot welders is indicated by the fact that machines on production assignments may be required to make welds at a rate as high as 130 spots a minute. Under the most severe conditions and heavy load, the effective life of some vital parts (contacts or bellows) may be as

Fig. 4—Housings of welder controls must be dusted inside at least once a week. This good housekeeping eliminates many troubles with delicate electrical circuits

short as one week. An oscillograph (Fig. 5) is used to check the timing cycle and current amplitude of each Ryan-owned spot or seam welder.

Maintenance of controls consumes the greater part of the time of the men who are primarily concerned with the care of the spot welders. The 25 machines are equipped with a wide range of controls, ranging from purely mechanical or pneumatic types through various combinations to completely electronic. It has been found that prompt replacement of any malfunctioning unit is the best way to keep machines in operation. Accordingly, spare control parts of all types—tubes, relays, contacts, switches, capacitors, transformers, valves, bellows, etc., are kept on hand. Once a defective part has been detected by inspection, it is removed and routed to the electrical shop for overhaul. After undergoing a functional test, it is placed in maintenance stock.

Routine inspections of the air-pressure systems of spot and seam welders (Fig. 6) are made to see that uniform pressure on the electrodes is maintained during welding. The air valves of pneumatic cylinders are checked frequently, twice a week or more often, for leaks, smooth operation and lubrication of those cylinders which most frequently require oiling. The use of neoprene packing has reduced cylinder maintenance greatly as compared to that required with the former leather packing. The newer type of packing has often rendered more than two years' service.

Fig. 6—A routine inspection of the air-pressure system on this seam welder assures that uniform pressure will be maintained

The spot welders are installed in several groups, each of which draws current from the general network of plant power feeders. Because of the heavy demand requirements, the machines of each area grouping are interlocked in such a way as to eliminate simultaneous operation and peaking of load. Inspection of the efficacy of these interlocks is an important part of the maintenance routine.

The Ryan Aeronautical Company operates 45 arc welders, mostly of the 150-amp size and having an average current output of from 50 to 80 amp. Generally, the maintenance of arc welders is simpler than that of spot welders. Burned rheostat contacts is the trouble most commonly encountered, and shutdowns for this reason are simply avoided by stocking spare rheostats. Standard maintenance practice calls for a general inspection of arc welders approximately once a month, including cleaning (dust removal) and a check on the condition and functioning of brushes and switches.

About five other welding machines are operated—flash welders and atomic-hydrogen welders—but the maintenance of these machines is a more individual matter. All are inspected regularly, however, for appropriate electrical and mechanical defects.

A general practice has been established to take each welder, arc or resistance, to the electrical shop once a year for general overhaul, renewal of wiring, etc. This practice could not be followed entirely during the years of rush production, but good preventive maintenance on the floor enabled many machines to be kept in operation for more than two years without general overhaul.

A record of the work scheduled and performed on each machine is kept in two-part loose-leaf form. The first part of this individual machine record, a cardboard strip 4½ by 11 in., overlies the 8½ by 11 in. sheet that constitutes the second part. Space is provided on the cardboard strip to enter a complete list of the work scheduled for the machine, and the frequency with which each operation is to be done. On the exposed right half of the underlying sheet there are columnar spaces in which the completion of each operation may be checked off over a 13-week period. A new sheet for each machine is provided at the beginning of each quarter.

How the System Works

These forms are distributed by Plant Engineering to the various supervisors of maintenance departments—electrical, mechanical and carpenter shop—who in turn give them to the inspectors. The latter make the inspection and repairs according to the instructions on the forms and return the cards to their supervisors after the work has been done. The cards are then checked and placed in a file.

Whenever an inspection discloses the fact that a major overhaul or repair is necessary, the mechanic writes out a special request to the supervisor, and the work is performed under specific instruction.

Lubrication of all equipment, including welding machines, is scheduled and performed in accordance with instructions printed on card forms. These cards are furnished by the Standard Oil Co. of California in accordance with directions given by the Ryan Aeronautical Co. They indicate the parts to be lubricated and the proper lubricant in each case. A white card is used for the plant engineering department, a tan card for the electrical maintenance files. The inspector makes his notation on large ruled sheets which allow space for a month's operation.

The employment of systematic methods coupled with clear written material for maintenance and lubrication has sharply reduced breakdown time at the Ryan Aeronautical Co. In addition, maintenance costs have been reduced by approximately one third because repairs and adjustments become evident before they can take on large proportions.

★ RESEARCH

Mr. Rector provides a much needed non-technical explanation of what radio-frequency heating is and how it can be used for brazing and hardening.

R-F Heating— *And Why It Works*

BY B. E. RECTOR
Electronics Engineer, Industry Engineering Dept., Westinghouse Electric Corp., East Pittsburgh

From limited use a few years ago, radio-frequency heating has spread today to such varied fields of industry as plastics, rubber, wood, food, textile and paper. In the metal-working field, it is used for soldering, brazing, annealing and hardening. The number of applications and number of installations are growing steadily and will increase still more rapidly as the possibilities are realized.

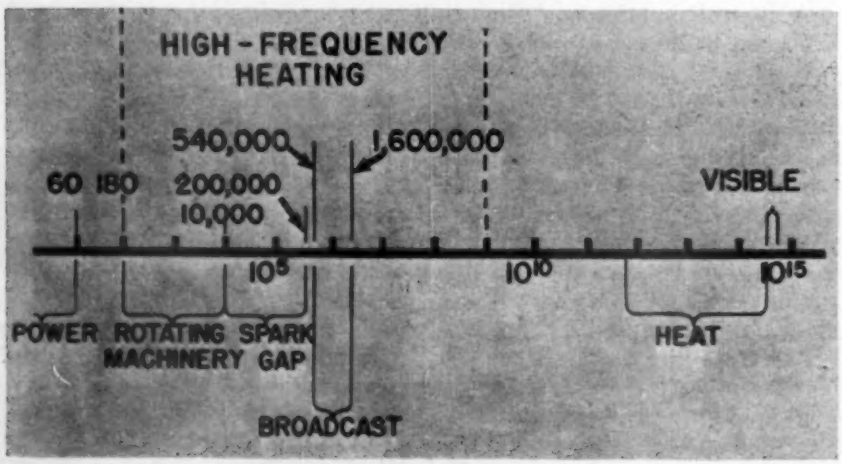
Definitions and Equipment

According to common usage, radio-frequency heating implies the use of alternating currents ranging from 200,000 cycles a second up to hundreds of millions of cycles a second—to use the shorthand of the trade, from 200 kilocycles (kc) up to hundreds of megacycles (mc). One kilocycle equals 1,000 cycles, and one megacycle equals 1,000,000 cycles. The term "high-frequency" heating is used more loosely to include not only the r-f range but also frequencies from 180 to 200,000 cycles.

Fig. 1 shows the high-frequency heating spectrum. Power in the 180 to 200,000 cycle range is usually furnished by motor-generator frequency changers or spark-gap generators. For most radio-frequency heating applications, power is supplied by electronic-tube generators. This is the device with which we are concerned here, for it is primarily responsible for most of the revolutionary advances.

The principle structural elements of radio-frequency generators are: (1) an electronic rectifier, which takes the incoming a-c power and delivers a suitable high-voltage direct current and (2) oscillator tubes and associated circuit elements, which change the direct current to alternating current of the desired radio frequency. There are also coils or electrodes for applying the r-f current to the work and various associated controls.

Fig. 1—Frequency spectrum (cycles per second). Radio-frequency heating does not begin until 200,000 cycles and extends into millions of cycles per second. "High-frequency" heating, a much looser term, may be said to begin at 180 cycles per second. It also includes the entire r-f range



The generating equipment has essentially the same function as (and bears a close resemblance to) the transmitter of a broadcasting station. In fact, much of the early experimental work in r-f heating was done with regular broadcasting equipment, and because of the experience gained in broadcasting the actual generation of r-f power for heating has been a lesser problem. Two* fundamentally distinct methods of applying r-f power are employed: by *induction* when the workpiece is of a material which is a conductor of electricity and *dielectrically* when the workpiece is a non-conductor (dielectric). Both these methods are shown diagrammatically in Fig. 2. In the metal-working field, we are almost entirely concerned with induction heating.

The phenomenon of induction is familiar to everyone who has an elementary knowledge of electricity. We know that when an electric current flows through a conductor it sets up a magnetic field, which is constantly changing if the current is alternating. We know also that a voltage will be induced in a second conductor if it is brought within this changing field, and a current will be forced to flow in it

* A third method of application is introduced with the development of microwave power.

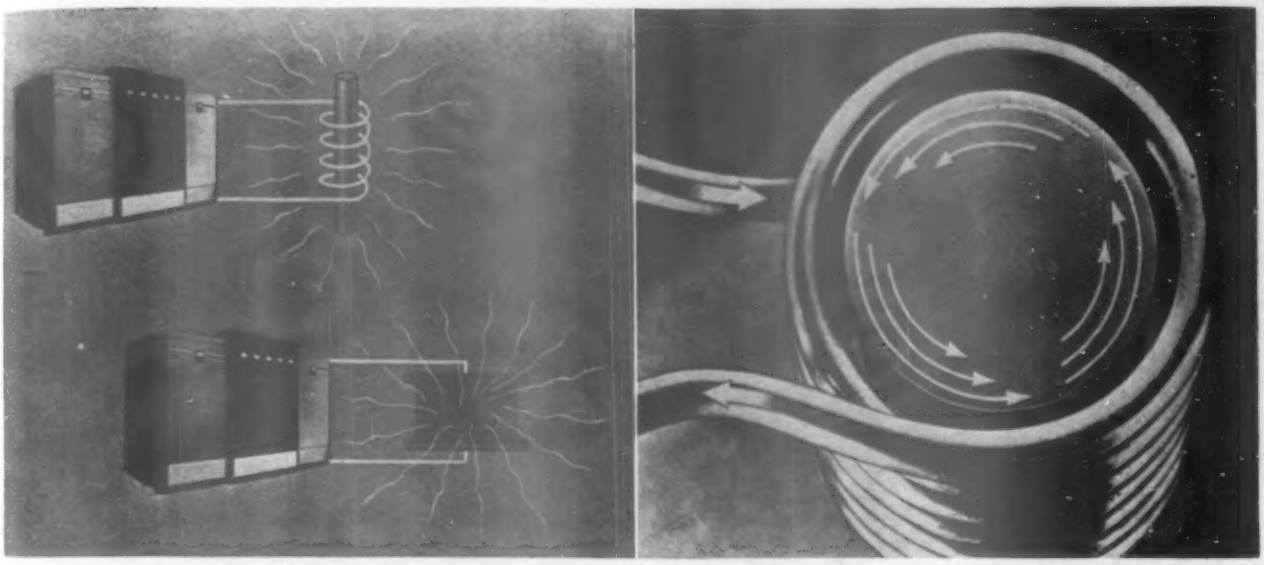


Fig. 2 (left)—In the upper diagram, r-f energy is transmitted through the coil and induces a similar current in the workpiece. In the lower diagram, the workpiece is a non-conductor or dielectric between two charged plates of a capacitor. Both conditions result in the development of heat. Fig. 3 (right)—The arrows show schematically how high-frequency current crowds to the outer surface of the object being heated by induction

also. Finally, we know that there is always resistance wherever there is a flow of electricity in a conductor and that the energy necessary to overcome this resistance appears as heat

These facts were utilized in the induction furnace, which is now an established method of melting metal or heating it for forging. The induction furnace, however, uses comparatively low frequencies, and does not come under the head of r-f heating.

Induction "Skin Effect"

Radio-frequency induction heating involves the utilization of still another characteristic of electricity. When we are dealing with direct current or with low-frequency alternating current, the current flow is substantially the same at the center as at the surface of the conductor. As the frequency increases, however, the current tends to be crowded to the outside of the conductor. When we get to a few hundred thousand cycles per second, virtually all of the current crowds to the surface (see Fig. 3).

This phenomenon is known as "skin effect" and is a vitally important characteristic of r-f induction heating because it permits sharp concentration of heat at the surface of the workpiece. Another advantage is that the depth to which the current can penetrate is determined in part by the frequency of the applied voltage. This means that we can control the depth of penetration very precisely by adjusting the frequency.

The advantage of precise depth control is shown in such applications as shaft hardening. Here the bearing surface must be made as hard as possible, while the core of the shaft remains tough and resilient. The problem is to heat the surface to a predetermined depth and temperature, but heat it so quickly that little heat will be transferred to the interior of the shaft.

For the induction-heating engineer, this problem is simple. The shaft is properly positioned within the inductor coil of a radio-frequency heater, and current is passed through it. The surface metal becomes red hot over the desired area so quickly that the heat has no time to wander off where it might do harm. When the correct hardening temperature has been reached, the power is automatically shut off and the hot surface quenched in water or oil.

Shaft hardening and similar operations can also be performed by passing the shaft through a coil at a uniform rate of speed. The speed is regulated so that the time of passage through the coil is just enough to allow the shaft's surface to reach the correct hardening temperature. The piece is automatically quenched by sprays of water from nozzles just below the inductor coil.

Contour hardening is another case in which the precise depth control of r-f induction heating is of great value. If hack-saw blades are hardened, for instance, the unheated cores still retain the desired toughness and elasticity. The same principle applies to gears of various types. Still another application is the hardening of internal bearing surfaces—a task almost impossible by any other method of heat treating.

Applications to Brazing

A second advantage of r-f heating is its precise area control. In the assembly shown in Fig. 4, a cover plate was brazed onto a tube without affecting another brazed joint located only ¼ in. away. Localized hardening or annealing of small parts is also accomplished easily by induction heating.

Finally, induction heating lends itself readily to the production-line method of manufacture. There are many applications, such as the brazing operation shown in Fig. 5,

Fig. 4—A brazed assembly. The previously made joint between the tube and cylinder was not affected by the heat developed to braze the cover plate in place

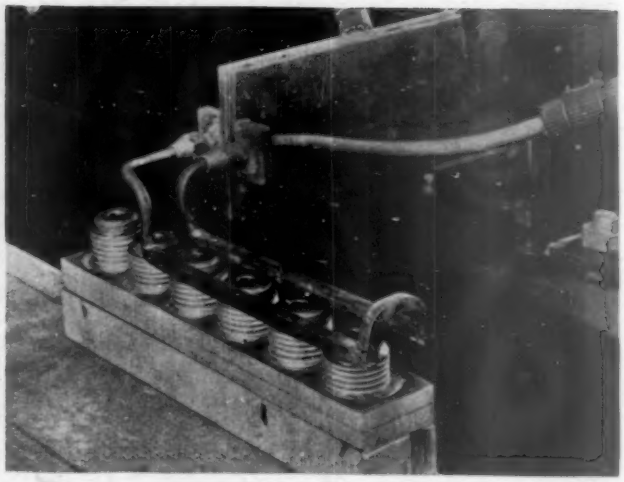


Fig. 5—Production-line brazing. The pieces are automatically brazed as they are carried by conveyor belt at a predetermined speed through the work coil

in which the parts to be heated can be carried through the inductor coils on conveyor belts or other feeding devices. Since control of time and temperature is automatic, relatively unskilled labor can be taught to do various jobs better and more rapidly than they were done by highly skilled men under former methods.

Dielectric Heating

Dielectric heating got off to a slower start, but it is now running a close second to induction heating in the radio-frequency field. Though the generating equipment is essentially the same, this type of heating poses more difficult problems since we are now dealing with frequencies of millions of cycles. Before the war, such frequencies would have been out of the question for industrial use, but the accelerated pace of wartime developments in short wave radio makes them practicable today.

The method of applying this very high-frequency power is based on the principle of the condenser or, more properly, the capacitor. Broadly speaking, any pair of conductors separated by an insulating material constitutes a capacitor. In dielectric heating, the conductors are a pair of metal plates (electrodes), and the piece to be heated is placed between them. The workpiece, it should be stressed, must be a material normally an insulator or dielectric.

Capacitors have a number of functions in radio and power work, but the function of this capacitor is based on a characteristic definitely undesirable in other applications. That is the tendency of the insulating substance to become hot when an alternating electric potential is applied to the electrodes.

Here is what happens in a microscopically small section of the material being heated when a rapidly alternating voltage is applied to the electrodes. Because of the electrical charges within the molecules, the rapid changes of polarity tend to make the molecules vibrate. The more rapid the reversal—that is, the greater the frequency—the more rapid is the vibration. This molecular motion produces heat.

One noteworthy characteristic of dielectric heating is the uniformity of molecular agitation throughout the dielectric. Molecules in the middle of the workpiece are shaken back and forth by the alternating field just as hard and just as fast as they are anywhere else. Hence there is no overheating at the surface and no underheating at the center.

The amount of heat procured by the molecular vibration is proportional to the frequency, since this determines the number of vibrations per unit of time; to the square of the applied voltage, since this voltage determines the amplitude of the vibrations; and to the so-called "loss factor," which is merely a way of saying that different materials have naturally different rates of heating.

The speed, convenience and uniformity of dielectric heating have led to its use in many applications. The marvelous new plywoods we hear so much about are one example. These plywoods are made possible by synthetic binders. The binders are thermosetting, which means that they must be heated after application. When older methods of curing by means of steam-heated platens were used, the thickest plywood that could economically be made was about one inch. With dielectric heating, however, thickness doesn't matter because the heat is generated within the material itself and does not have to seep in from the surface. Consequently, plywoods can now comprise as many as 148 layers of birch veneer and measure over a foot thick.

Other applications in which dielectric heating has demonstrated its value are textile drying and twist setting, the curing and drying of rubber, bonding of laminated plastics and wood, thawing of frozen foods—the list is still growing.

It should be noted that none of these applications of dielectric and induction heating are "experimental." Radio-frequency heating has passed out of the laboratory stage and has established itself in regular industrial production. The equipment now in regular use totals many thousands of kilowatts.

Welded Steel Drier Rolls*

Development of the jacketed-type steam drier roll has greatly improved production in such industries as paper, textile, rubber, chemicals, etc. Weld-fabrication offers a multitude of engineering advantages over cast rolls.

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IN THE early 1930's, a welded steel, single-shell drier roll was installed as a replacement in a bank of cast-iron drier rolls operating in a mill making paper board. This pioneer installation provoked considerable thought and discussion because of its thinner shell, increased operating efficiency and longer bearing life which resulted through improved journal design. These advantages have continued over more than 12 years of nearly continuous service.

Here was a new field for fabricated steel. Since then, steel drier rolls have been accepted by many different industries such as paper, printing, textile, film processing, plastics, rubber and chemicals. It is the purpose of this paper to discuss some of these installations.

The early single-shell drier roll duplicated the overall design of a cast-iron roll. Fig. 1 shows this roll as it appears in the drying machine. The roll is 3 ft 6 in. OD by 10 ft 6 in. face. The journals are designed with an insulating air chamber between the steam passage and the bearing to reduce the temperature on the bearing.

THE DOUBLE-SHELL ROLL

Some engineers saw in the use of fabricated steel design a means of improving several features of the conventional single-shell drier roll design. A large-diameter, single-shell roll requires very thick head sections, which could be eliminated if the steam were confined to an annular space between two shells.

Fig. 1—An early drier roll used in paper manufacturing. With shell and head made into an integral piece by welding, this roll duplicates the design of the cast-iron roll which it replaced

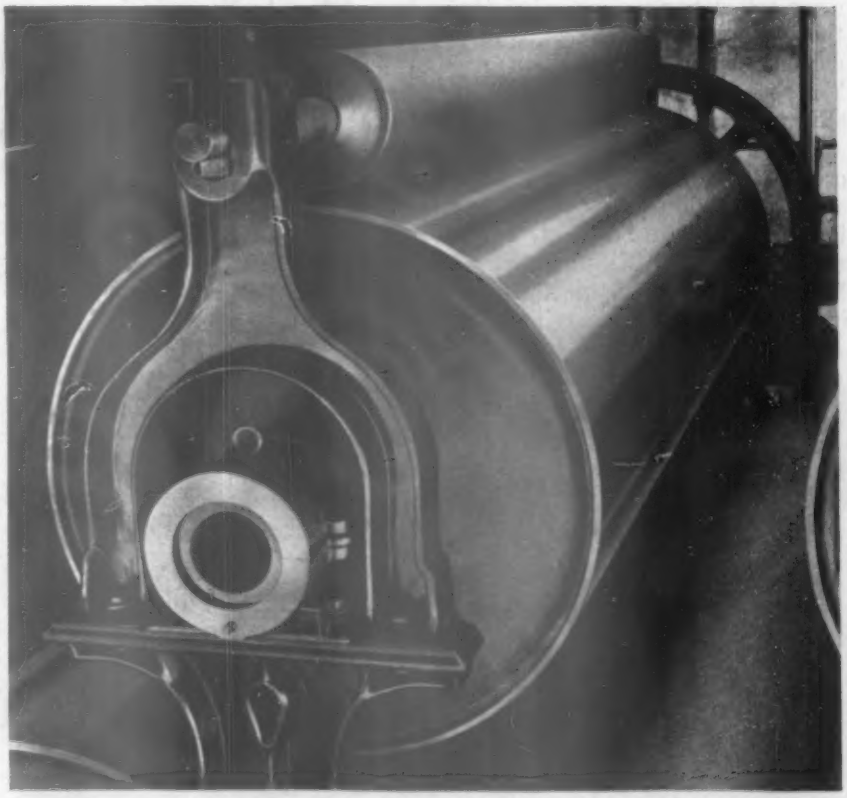
★ DESIGN

Since the higher-strength steel plate would allow the use of lighter gauges for the shells, two shells plus internal stiffeners would weigh little if any more than a single cast-iron shell. Fig. 2 shows unmachined jacketed drier rolls of the new design. These rolls have a 6-ft OD and a 5-ft face. The face was machined to a polished finish.

Fig. 3 shows a schematic drawing of a section of a double-shell roll. The flat head plates which close off the ends of the steam chamber (and support the shells by spokes from the journals) also provide the means of passing steam into the annular shell space. Half-pipe sections are welded to the spokes, and holes are drilled in the inner shell and journals, forming a steam passage through one journal, across the face of the roll and out the other journal. Some of the earliest jacketed-type steel drier rolls designed and built in this manner were used by a publishing company to dry printer's ink.

The next consideration in furthering the design of the jacketed steel drier roll was better condensate removal. A Yankee drier roll, 8-ft OD by 6-ft, 10-in. face was built with two provisions for

* Abstract of a paper presented at the annual meeting of the American Society of Mechanical Engineers, Dec. 2–6, 1946, New York City.



condensate removal incorporated in its design. Every section on this drier roll (Fig. 4) is now serving a double function since each piece is a strength member and is also part of a steam passage. The steam inlets have become pipe spokes, and the end plates have become rings acting as closure plates only.

Pipe Spoke Design

Condensate is removed at slow speeds by a scoop designed to pick up the water lying at the low point of the drier. This does not serve at higher speeds since the condensate rotates with the roll. A pipe is, therefore, inserted through the inner shell to draw off the condensate. The open end of the pipe is very close to the inner surface of the outer shell. Valves in the condensate lines make it possible to use the drier roll at any speed and still evacuate the condensate. The pipe spoke design for the passage of steam is an improvement over the earlier drier rolls because there are no unheated sections to restrict roll expansion. Stiffeners on the inner shell have been eliminated. These drier rolls may be closed at the ends to keep heat losses from the inner shell at a minimum.

The operation of this first Yankee drier roll definitely indicated that the jacketed-type design was more efficient than a single-shell roll. To produce paper satisfactorily, the steam pressure had to be reduced and the speed of the machine increased. Though it uses exhaust steam instead of live steam from a boiler, this jacketed-type steel drier roll currently produces more paper than was possible with the cast-iron roll. Tissue paper has been creped from this roll ever since it was installed, and the doctoring† action has not been detrimental in any way.

The field of use for jacketed-type steel rolls was also extended. Fig. 5 shows an unmachined 10-ft-OD roll designed for the processing of light plastic films. The nature of the product requires the rolls to use warm water as the heating medium and to operate with a very uniform surface temperature. The warm water is distributed through the small pipes and the diffusing manifold inside the inner shell. The large pipe spokes on each end of the roll are the return lines, and the heavy blocks on the spokes are for attaching the driving mechanism. The face of this roll will be polished to a high finish.

A jacketed-type roll of 2 ft 6 in. OD was fabricated for a pharmaceutical company to flake, by doctoring, a product of crystalline form. This roll (Fig. 6) has given trouble-free service for about seven years at an approximately 20% higher rate of production than that of similar units using single-shell rolls. The end construction has been ribbed to provide additional stiffness for the unusually long journal. The end plates also have passageways to allow steam to get to the jacket space.

Jacketed rolls are supplied to chemical manufacturers to meet high-temperature requirements of around 700 F. Such rolls as Fig. 7 have a variation of the jacketed design which may best be described as a "labyrinth"‡ (see cutaway section). Rolls of this type are particularly applicable for installations that require very high pressures, very high (or low) temperatures or a heavy load applied externally. The total thickness of the shell plate may be as much as 2½ in. and still allow the steam passages to be very close to the outer roll surface.

† Doctoring: a scraping action on the face of the roll for the purpose of creping, flaking, cleaning or polishing.

‡ For further information see, "Fabricated Steam Platens," page 39, December, 1945, Welding Engineer.

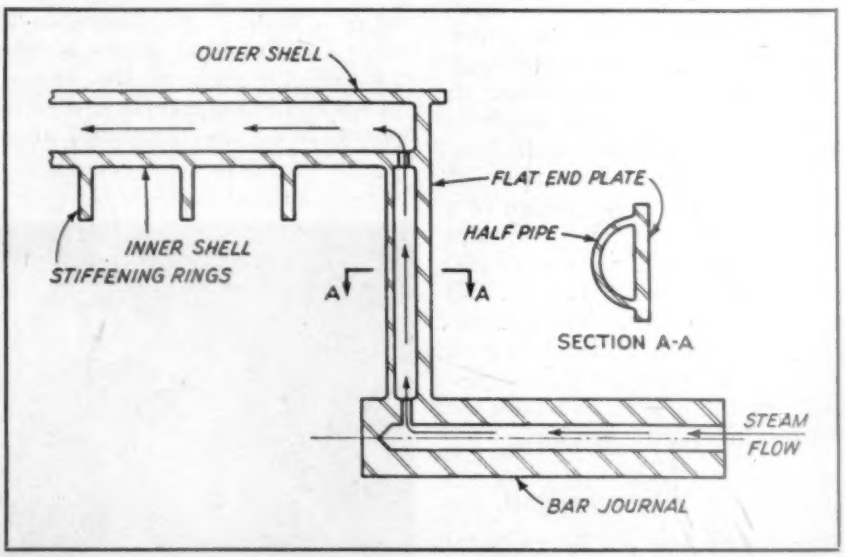


Fig. 3—Schematic drawing of a quarter section of a jacketed-type drier roll. Note direction of steam flow. This is a typical early design

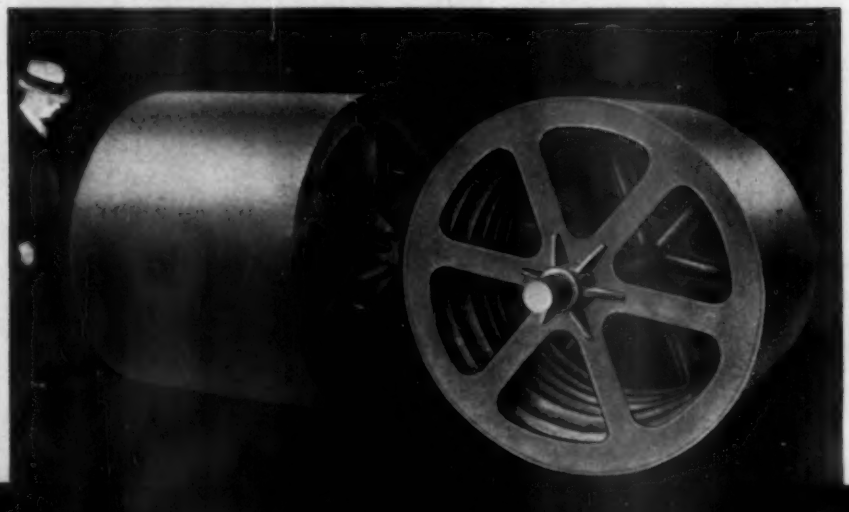


Fig. 2—Unmachined, jacketed rolls, 6-ft OD, 5-ft face. Two light shells plus internal stiffeners replace the heavy shell of the cast-iron roll

The advantages to be gained by the use of the jacketed-type roll for drying, cooling or other processing done on drum-type rolls can be grouped in four categories: (1) Welded steel fabrication makes possible a wide range of roll design. (2) The design contains mechanical advantages that are not found in any other type rolls. (3) The jacketed-type steel roll has features which will raise its operational efficiency above that of the conventional-type rolls. (4) Savings are effected in initial costs, operating expenses and operating time.

The design of a jacketed-type steel roll is restricted only by the imagination of the designer and certain physical limitations such as available fabricating facilities and transportation problems. Questions typical of those which must be answered are:

Can a cylinder of 10-ft OD with a 16-ft face be formed from 2-in. plate? Are assembling and welding facilities adequate? Are furnaces available to stress relieve a roll of the size desired? (Stress relieving, it should be noted, is considered a necessity if the roll is to hold its true shape in operation, and the manner of stress relieving has been found to affect the dimensional stability of the machined drier roll.) Are machining facilities available for a roll of the size contemplated? Can the type of finish desired be obtained?

These typical limitations are the only kind imposed on the designer. The costs of special patterns or dies do not have to be considered. The designer, however, must consider rigidity and strength under operating loads and pressures, and code requirements for pressure vessels must be observed in most installations.

Mechanical Advantages

The limitations are in no way alarming, for the possibilities in welded steel designs are virtually untapped. Rolls can be made for higher pressures than were practicable before and made to give uniform temperatures over the entire face. To resist corrosion, a roll can be designed with either a solid stainless shell or a clad shell. Chromium, nickel or other plating may be placed on the face.

The mechanical advantages vary with the size of the roll and the design selected. A jacketed roll of 3-ft, 6-in. OD and under will not be lighter than a single-shell roll, but on larger diameter rolls an appreciable weight saving is reflected in the design of the supporting frames and in the drive unit for the roll or rolls. The bearings can be smaller, both because of this weight saving and because the greater strength of steel permits smaller journal diameters.

There is added mechanical safety in the use of welded rolls. If, for any reason, too much pressure is applied to the roll, the steel plate will distort to a noticeable extent before fracture occurs. This reduces the chance that a roll failure may cause property damage or personal injury. For example, a drier roll 10-ft OD by 8-ft face was designed for a steam pressure of 100 psi. The roll was machined under a water pressure of 100 psi and was being prepared for a final hydrostatic test at 200 psi. Accidentally, the pressure was raised much higher than the 200 psi specified. Instead of exploding, however, the weakest section of the roll, the outer shell plate, distorted and relieved the excess pressure. The permanent distortion of the shell plate (see Fig. 8) was the only indication of failure. The maximum permanent set was about 1¼ in. Still higher pressure would probably have blown a hole in the shell, but there would have been few flying fragments.

The welded roll, designed correctly for its intended use, has operational advantages over a conventional cast roll. The jacketed design guides the steam in a re-

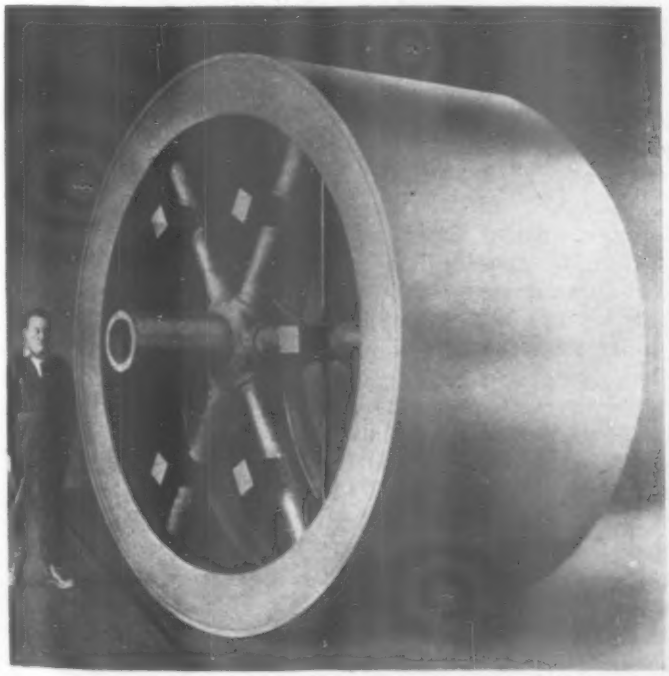
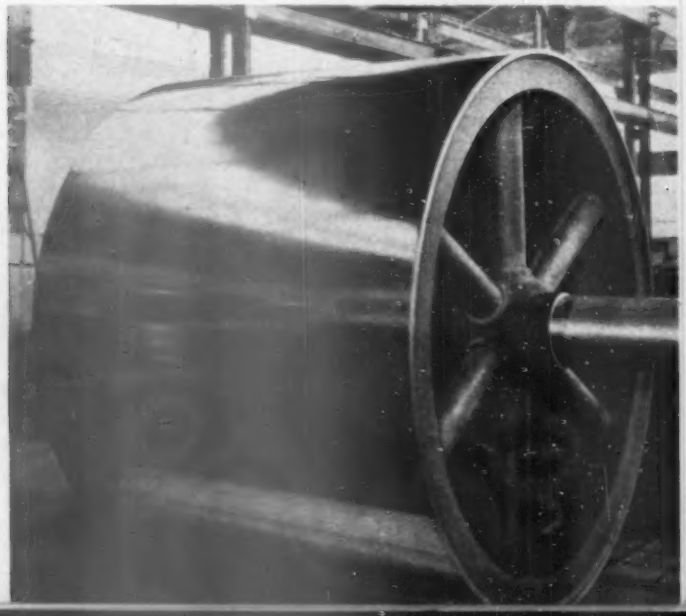


Fig. 5 (left)—Hot-water drier roll to be used in the processing of light plastic film. The blocks welded to the spokes provide for attachment of the driving mechanism

Fig. 4—Yankee drier roll designed for more efficient removal of the condensate. Stiffeners have been eliminated, and each section serves as a steam passage



stricted area across the inner surface of the face of the roll. The net inside cross-sectional area which contains steam is therefore much less than that of a single-shell roll. The steam velocity in the jacketed roll, therefore, must be greater by the same ratio as the net cross-sectional area is smaller.

The greater steam velocity offers four advantages. First, it reduces the film on the inner surface of the shell plate. This film offers considerable resistance to heat transfer through the shell. Second, it minimizes the possibility of dead steam in the roll.

Third, the higher velocity gives better insurance that air in the entering steam will be flushed out immediately with the exhaust steam and condensate. Dalton's Law of Partial Pressures states that the total pressure exerted by a mixture of gases is equal to the sum of the pressure which each gas would exert if it alone would occupy the whole volume. This law can be interpreted to mean that any air in the steam chamber of the drier roll will cause the actual steam pressure to be lower than that indicated by a gauge in the steam line. As a result, the temperature in the drier roll will not correspond with the steam temperature at that pressure. Just a small percentage of air in the roll reduces the drying rate of the machine.

Fourth, the greater velocity of the steam and the guiding feature of the narrow steam passage act together to maintain a more uniform surface temperature across the face of the roll.

Heat Transfer Improved

Unfortunately, the nature of the increased operating speed, which is a measure of the productive efficiency of the drying machine, cannot be calculated to any degree of accuracy. There are too many indeterminate variables in addition to the roll itself that have a direct bearing on the drying rate.

In the basic formula for heat transfer, the heat transferred is given as the product of the area, the temperature difference between the steam and the sheets to be dried and the overall coefficient of conductance. The last-named factor, U, is derived from the formula:

$$U = \frac{1}{\frac{1}{h_1} + \frac{1}{h_2} + \frac{1}{h_3} + \frac{1}{h_4}}$$

Fig. 9 shows the various components of the overall conductance. The jacketed-type steel roll is not thought to affect appreciably the values of h_3 and h_4, the conductance of the metal shell and the conductance of the film on the outside of the shell, respectively. It is assumed then, that h_1 and h_2, the conductance of the condensing steam and the inner film, are the factors which cause this better heat transfer. How to evaluate this assumption is not definitely known. There is very much more development required before the best heat transfer rates will be obtained for the jacketed design.

A practical test confirms the theoretical assumptions. Ten jacketed, 3-ft-OD drier rolls of the type shown in Fig. 10 were installed in a paper machine in a felt mill to replace ten cast driers in a bank of 54 single-shell cast-iron rolls. The operating steam pressure for the cast-iron rolls was 50 psi, while the pressure of the jacketed rolls was increased to 150 psi. No other changes were made in the machine or in its operation. The production rate was increased approximately 8 to 10% over the average rate before the replacement. Keeping in mind that this installation has only 10 out of 54 rolls changed, it can be figured that at 150 psi pressure the jacketed drier rolls show an increase in efficiency of from 40 to 50%. The efficiency increase due to the increased pressure (based on data collected from several sources) is estimated to be about 30 to 33%.

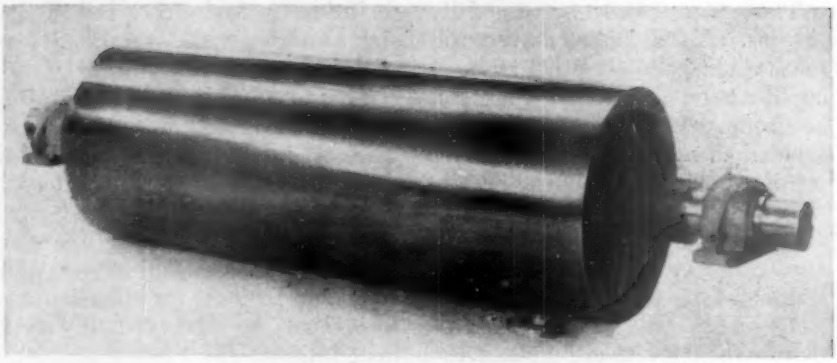


Fig. 6—Chromeplated jacketed-type roll used by a pharmaceutical company. Ribbed end construction gives additional stiffness for the long journal

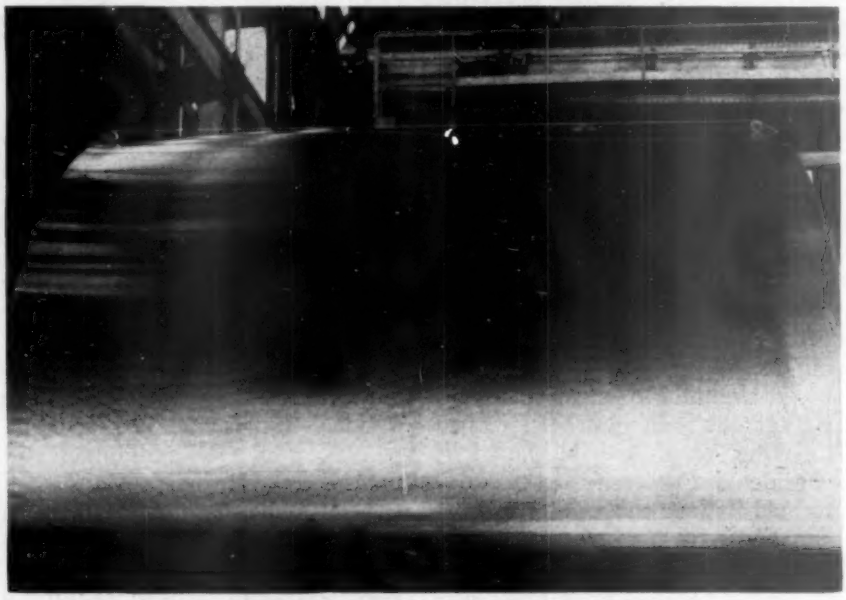


Fig. 8—Shell plate distorted by excessive pressure. The maximum permanent set was about 1¼-in., and the remainder of the roll was not damaged

The remaining increase in efficiency of about 15% must be attributed to the jacketed steel design.

In order to determine the relative efficiency of the jacketed-type steel drier roll at the original operating pressure of 50 psi, the pressure was reduced to that value, and observations were made with the machine running under conditions similar to those existing before the steel drier rolls were installed. Results indicated that the residual moisture content of the sheet was 28% less when the steel drier rolls were used, and that the average operating speed was increased 4.6%. Again noting that only 10 of the 54 rolls were replaced with steel drier rolls, it can be seen that each jacketed-type steel drier roll demonstrated an increase in efficiency of nearly 25%. A conservative appraisal indicates that 18% is a safe figure for increased efficiency of small-diameter drier rolls.

Other Savings Effected

The jacketed-type steel drier roll reduces the amount of floor space needed by reducing the number of driers required. Medium to large rolls are, by comparison, more economical to purchase. Frame and bearing costs are lower because of reduced weight. And if a shell plate for a steel roll is damaged in processing, it can be repaired or replaced by welding at a fraction of the cost of casting a new roll.

Data are now available on the fabrication of nearly 200 steel drier rolls operating in many different industries. All of these rolls have satisfactory performance records.

There are certainly some problems which are yet to be overcome by the designers of jacketed steel rolls. At present, a weldable steel is not available to give a surface hardness comparable to cast iron. This may or may not be detrimental when doctoring is necessary on the drier roll. Additional research to improve the condition is still to be performed by steel fabricators and manufacturers of doctor blades.

Present designs available for jacketed-type rolls undoubtedly will be improved upon as more operating data are collected.

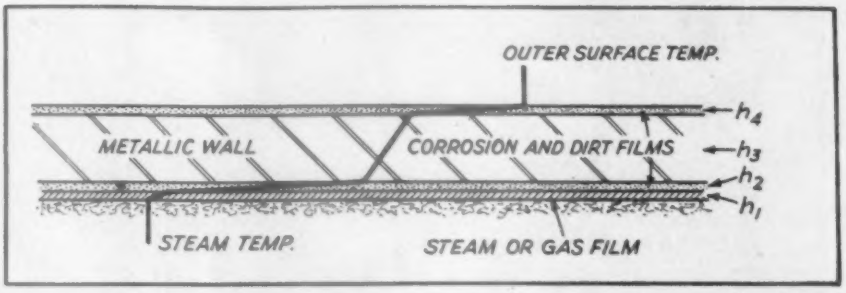


Fig. 9—Schematic drawing of metal-wall section. The various "h's" represent the heat conductances of: h_1 condensing steam, h_2 dirt and scale inside shell, h_3 metal shell, h_4 corrosion and dirt film outside shell

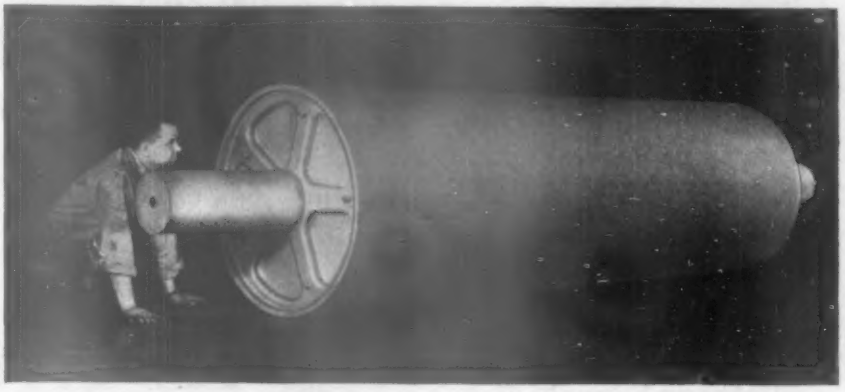


Fig. 10—This jacketed-type roll for a felt mill made it possible to operate at a steam pressure of 150 psi. Even at the former operating pressure of 50 psi, it was still more efficient than the cast-iron roll it replaced

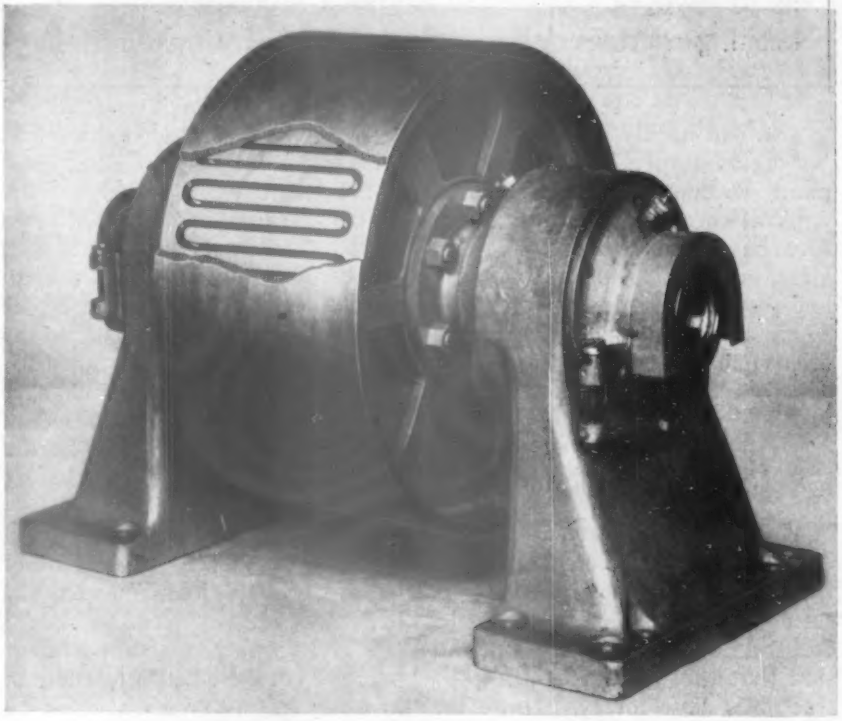


Fig. 7—"Labyrinth" steam platen adapted for use as a drier roll. Rolls of this type will withstand extremely high temperatures and pressures

Fig. 1—Longitudinal and circumferential seams of this rotary kiln were welded automatically, and wrapper plates and riding rings were added by manual welding

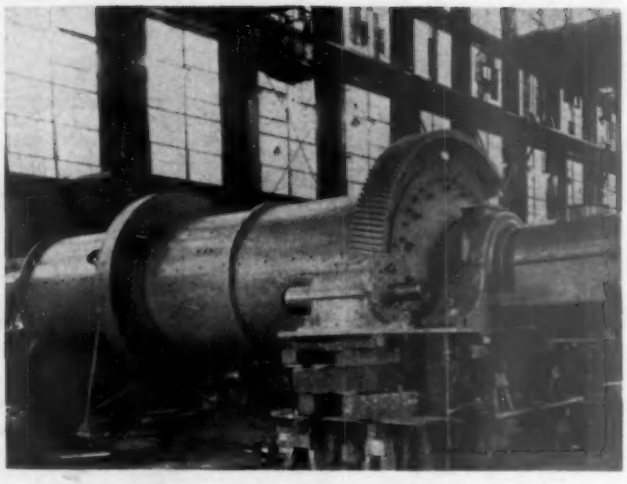


Fig. 2—All-welded two-compartment ball mill, 26 ft long by 7-ft diam, for a cement plant. Most of the welding was done with automatic equipment

★ MAINTENANCE

Welding in the Cement

The cement industry early recognized the possibilities of welding as a means of building new equipment and keeping existing equipment in perfect operating condition.

One can hardly turn in any direction in a modern cement plant without seeing a welding application. The building structures have been erected by welding; kilns, coolers, elevators, ductwork and pumps have also been welded. There are actually very few pieces of equipment in a cement plant to which welding, in some form or another, cannot be applied.

New Construction

Most of the main structures and equipments are erected by contractors so that the primary concern of the cement producer in construction welding is to make sure that the welding by the contractor is satisfactory. However, after the plant has been turned over to the producer, he looks to welding for replacement of parts and repairs.

Fig. 1 shows an all-welded kiln with a shell of $^{13}/_{16}$-in. steel plate. If this plate were riveted, considerable extra steel would need to be used in overlap of the plates and in the rivet heads. Also the interior of a riveted kiln is very irregular, making it difficult to lay the brick liner evenly. In time the radical temperature changes occurring within the kiln loosen rivets and thereby cause deflection with resultant cracking and loss of fire-brick liners. For these reasons, all-welded kiln construction will give a liner life considerably longer than that previously experienced.

Fig. 2 shows a two-compartment ball mill of all-welded construction. Most of the welding was done by automatic equipment. This mill is lighter, neater and sturdier than one of riveted design. Efficiency of the welded joints is about 90% as compared to about 70% for riveted construction.

Fig. 3 shows one part of a jaw crusher being fabricated by welding. By positioning this subassembly, excellent appearing welds of high strength can be made at high speed.

Fig. 4 is a picture of a five-yard dragline bucket being fabricated by arc welding. This bucket can probably be built for less money than one of riveted construction, and it will certainly outwear the riveted bucket.

Maintenance of Facilities

A quick method of repair is an absolute necessity in a cement plant, where the process must be continuous on a 24-hr-day, 7-day-week basis. In one cement plant the main drive base of a rotary kiln 280 feet long and 10 feet in diam was broken in a number of places.* This base was cast iron and could not have been changed

*The Welding Engineer, Aug., 1945, "Welding in a Cement Mill" by T. B. Jefferson.

Fig. 3—Raw materials for cement must be thoroughly crushed and ground before they reach the kiln. Here a half of a jaw crusher is being positioned for downhand welding

Fig. 4—Welding is also used for the quarry. An example is this welded 5-cu-yd dragline bucket

Industry

BY AUBREY SMITH AND WALTER J. CAMPBELL

without chipping out the old foundation, then setting and regrouting the new frame to the foundation. It was welded by a copper-nickel alloy electrode at a cost of $1,500. A new base installed would have cost between $3,000 and $4,000, to say nothing of the delay.

Equipment used to handle such abrasive materials as sandstone, shale, gypsum, clinkers, cement and coal is bound to wear. The buckets and lips of conveyors and elevators are often fabricated and hard-faced; many other conveyor parts are repaired and hard-faced as well. In pumps, welded repairs are made on many parts, and impeller shafts, slurry housings and turbine blades are hard-faced.

Crushers and grinders are subjected to a terrific beating during operation, and it is very advantageous to be able to repair or hard-face such parts as agitators, adjusting plates, crusher mantles and chute plates. In one case the crusher barrel of the main frame was cracked so badly as to cause an eccentric bearing to lose its lubricating oil. Since it was impossible to operate the crusher without lubricating this bearing, the barrel had to be repaired or replaced. Again the material was cast iron, weighing 25 tons. A new base would have cost $10,000 plus shutdown losses. The welded repair cost $1,500 and was completed in 220 hours.

We have mentioned only a few of the equipments that can be kept in service by welding. Worn parts can be quickly removed by flame-cutting, and a new section fabricated and then joined to the old section by arc welding. An excellent example of this type of repair is shown in Fig. 5. This picture illustrates a method of replacing a wornout riding ring on a Polysius rotary kiln. The steel plate was rolled in one section, and the longitudinal seam welded automatically. A wrapper plate was slipped around the bars, which had been welded to the shell, and the riding ring was fitted over this plate. Movement was prevented by welding lugs on both sides of the ring. The bars on this section reduce the heat transfer to the riding ring, thereby reducing the expansion and contraction of the ring. This complete operation probably resulted in a minimum shutdown of the kiln, and it will increase the life of the apparatus considerably.

Hard-facing Prolongs Life

One of the widest uses of welding in a cement plant is for hard-facing. One example may be seen in Fig. 6, a roll head which has been hard-faced and used until the hard-facing has been worn down (left picture). Notice that the weld has not spalled off. In the right picture, the roll head has been resurfaced and is ready now to give longer service than was obtained on the original part. In this way, tools, crushers, grinders and agitators can be used almost indefinitely.

Hard-facing has been so success-

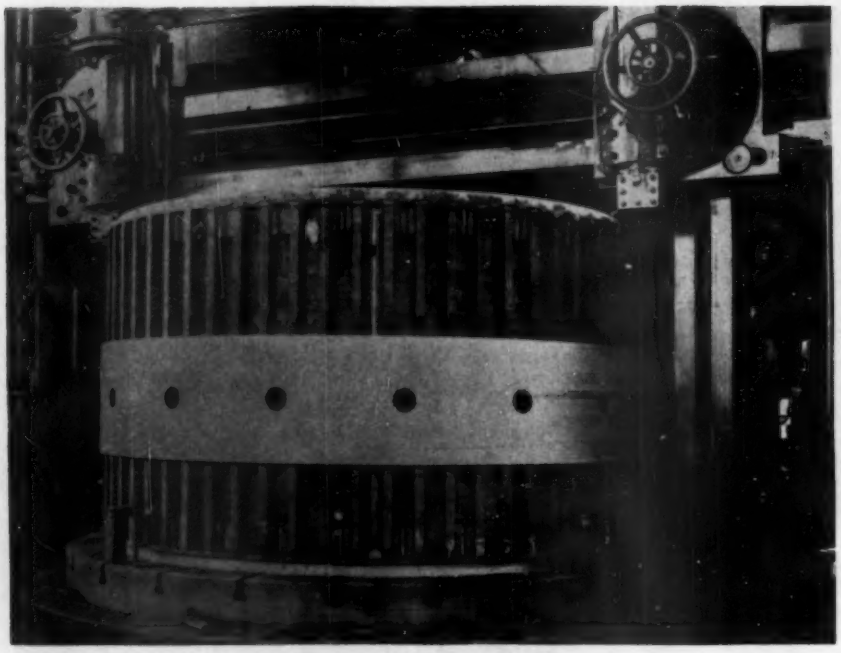


Fig. 5—Section of a Polysius rotary kiln on the boring mill, ready to be machined. The wornout riding ring will be replaced by welding

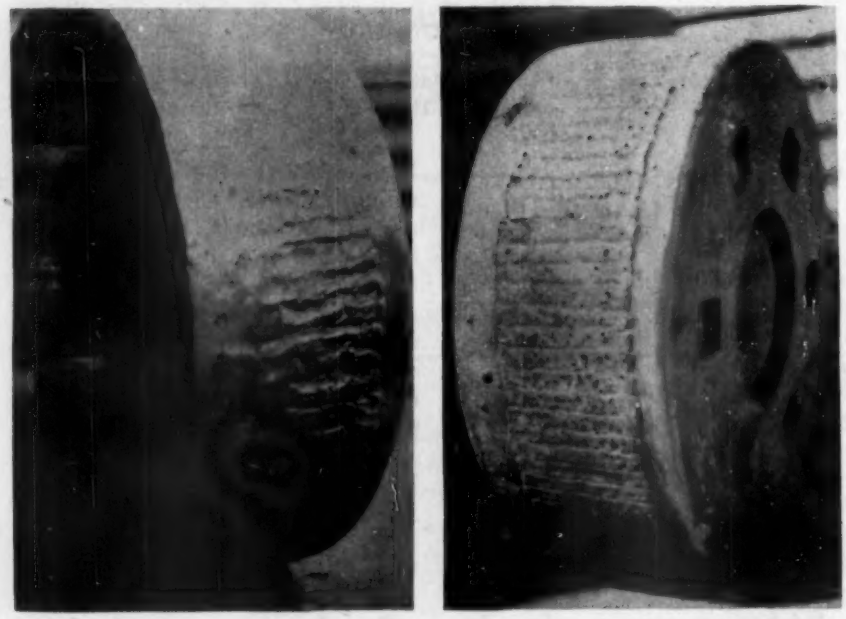


Fig. 6—Hard-facing can be added over and over, as shown by these two views of a hard-faced roll head. On the left, the hard-facing has worn down to where the application should be renewed, as shown on the right

ful in prolonging the life of parts that in many instances new parts are machined and built up by hard-facing before installation. Some manufacturers now furnish new parts already hard-faced. There are cases where a hard-faced crusher jaw has lasted 500% longer than a new part not hard-faced. This procedure prolongs the interval between the teardowns that are eventually required to replace worn parts.

A few more of the parts being successfully resurfaced in most cement plants today are crusher jaws, gyratory crusher mantles, roll crusher tires, sheepfoot tampers and plows.

In the quarry, drills, shovels, skip hoists, bulldozers, locomotives, compressors and pumps all have wearing parts. While the removal from service of a piece of this equipment would not be as great a calamity as that of a crusher or elevator in the plant, still it might slow down output if spare equipment were not at hand.

On a tractor, it may be necessary to build up track roller, track rails, idler wheels, grousers and bulldozer tips. Fig. 7 shows repairs made to one tractor. The main sprocket was hard-faced, and the cracks in the cast-iron housing were chipped out and repaired by metal-arc welding. All of this work was done without disassembly of the tractor.

The difference in wear between new and hard-faced sprockets is shown vividly by Fig. 8. The sprocket on the left was hard-faced, and the one on the right was new. Both were installed at the same time. The teeth of the new sprocket have worn down to a thin, pointed condition, but the hard-faced sprocket is still serviceable.

On shovels, it is advantageous to build up teeth, dipper fronts, track pads, driving tumblers and idler wheels. All of these parts can be economically reclaimed by welding to give considerable service under severe conditions. Much of this work can be done on the job, but parts like bucket teeth or pads, which can be easily dismantled, should be taken to the shop where better conditions permit better workmanship.

In the Welding Shop

If the cement plant has its own welding shop, many small parts may be repaired on a production basis or new parts fabricated. Either a-c or d-c equipment can be used to good advantage in the welding shop.

For building up surfaces where electrodes of the right composition are not available, atomic-hydrogen arc equipment may be used with scrap metal as filler. The atomic-hydrogen arc can also be used for fabricating light-gauge metals in ways not otherwise possible. Expenditures for positioners and preheating equipment for the welding

shop may be justified on the grounds that they assist the operator to do a better job more economically.

Each type of welding equipment has certain advantages over other types for particular applications. These advantages are not always constant. A few years ago, for instance, only d-c equipment was ever considered for structural welding, but with the development of high-quality, all-position a-c electrodes, many operators have become very partial to this type of welding. The main reason for this partiality is the fact that magnetic arc blow is almost completely eliminated, making it much easier for the operator to weld in corners, etc. On the other hand, d-c equipment is a little more versatile than a-c equipment.

Portable d-c and a-c equipment can both be used to good advantage for repair work throughout the plant. Since the d-c generator can be driven by an a-c motor, only one power supply is needed for both types. So far as welder versatility is concerned, the determining factor is the availability of electrodes for operation on each type of current.

For work throughout the plant, power outlets should be so located that not more than 200 ft of welding cable need be run from the welder to reach any job.

Use in the Quarry

Power lines are usually available for operating motor-driven generators in the quarry, but in many cases excessively long leads are necessary to reach the job. This results in considerable power loss and loss of time in hauling around the long lengths of cable. Portable engine-driven welders should be particularly useful in the quarry to avoid power loss.

To summarize, this article is intended to bring out several points which should result in large savings to the cement industry. It has been shown how the initial cost of equipment is reduced by welding, and how the service life of this equipment may be prolonged almost indefinitely by making welded repairs. Expensive shutdowns are prevented by on-the-job repairs and wearing surfaces improved by hard-facing.

The cement industry was one of the first industries to recognize the possibilities of welding, and I am sure that new developments in welding will readily obtain recognition in this field.

In conclusion, we wish to thank the Traylor Engineering and Manufacturing Co., Allentown, Pa., for supplying photographs of welded equipment and information; the Arcway Equipment Co., Philadelphia, for some excellent examples of hard-facing, and the several General Electric employees who contributed in procuring the information which went into this article.

Fig. 7—Main tractor sprocket after building up teeth with hard-facing. The cracks in the cast-iron tractor housing were repaired by welding

Fig. 8—These hard-faced and new tractor-tread sprockets were installed at the same time. Note the thin, worn teeth of the new sprockets (right). The hard-faced sprockets (left) are still in a satisfactory condition

Powder-

★ OPERATION

BY D. H. FLEMING
Development Engineer,
The Linde Air Products Co.

Fig. 5—A nozzle-end view of a machine-cutting attachment showing the powder jets surrounding a standard tip

THE alloying elements, chromium and nickel, which impart the desirable properties to stainless steels, have made these steels difficult or impossible to process by normal oxy-acetylene cutting. When any oxy-acetylene cutting is applied to stainless steels, the chromium (which has a high affinity for oxygen at elevated temperatures) immediately forms a highly refractory oxide on the faces of the kerf and so prevents further oxidation. Nickel does not appear to present so much of a problem inasmuch as a refractory oxide of this element is not formed.

SEVERING METHODS

A number of means have been used in the past to get around the refractory effect of chromium oxide. The most commonly used process involves an oscillatory motion of an ordinary hand-cutting torch, Fig. 1. An extremely heavy preheat and oversized tips are used. The overall economy of the process is not very good, for the cutting is quite ragged and the speeds are slow. Fig. 2 shows a comparison of hand cutting on 4-in.-square billets by the oscillation method and by powder. Using the same size of tip and operating conditions, the time required by the oscillation method was 3½ times that required by the powder-cutting method.

A second method is to hand-feed an iron rod or wire into the reaction zone. The rod is semi-atomized when it comes in contact with the cutting-oxygen stream and provides molten droplets of iron oxide to act as a fluxing agent in the cutting. A third method is to use a plain-carbon-steel waster plate on top of the stainless steel. The products of oxidation produced in the waster plate are washed onto the stainless steel and provide the necessary heating and fluxing action. A fourth method is the use of a carbon or metallic electrode to melt away the stainless steel. This last method is extremely slow, particularly on large sections, but requires little skill inasmuch as it is simply a melting action from the heat of the arc. At best, these techniques give a cut that is suitable for only the roughest work.

Because of the limitations of these severing methods, mechanical means have been used almost exclusively for the conditioning and cutting of stainless materials. Now, at a considerably faster pace, powder-scarfing is doing the job of conditioning that could previously be handled only by grinding, chipping, nibbling, multiple-drilling, cold sawing or other relatively slow machining operations.

To provide a high-quality cut surface, it was necessary to devise some means for either melting or fluxing out the chromium oxide. A great variety of powdered materials have been tested, including individual metallic powders, mixtures of metallic powders, mixtures

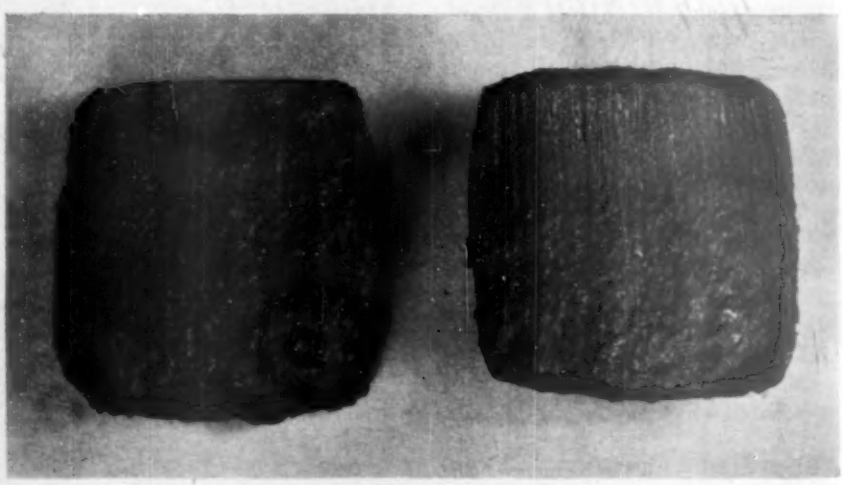


Fig. 2—The cut on the 4-by-4-in. billet at the left was made by the oscillation method; the one on the right was made with powder. The first cut required 3½ times the cutting time of the powder cut; metal loss in the kerf was twice as great

Cutting and Scarfing*

Stainless and other oxidation-resistant materials have offered seemingly insuperable difficulties to flame-cutting. A way has now been found to handle them at approximately the same speeds and with the same quality as cuts on plain-carbon steels

of metallic and non-metallic powders, etc. The net result was the selection of a finely divided iron-rich powder that satisfactorily meets the following requirements:

(1) Non-hygroscopic material

(2) Liberation of intense heat during combustion

(3) Products of combustion provide fluxing action

(4) Products of combustion are non-irritating and non-toxic

(5) Good process economy

In cutting operations this powder is usually blown into the oxygen stream from outside of the preheat flame, while in scarfing the powder is drawn into the oxygen stream within the nozzle. In both cases, the powder is heated to ignition temperature by the oxy-acetylene preheat flame and burns in the oxygen stream to create a high-temperature reaction. The extreme heat of this reaction makes it possible to start cutting or scarfing without pausing for any preheat period. As soon as the cut progresses into the material, the refractory oxides are continuously removed by a combination melting and fluxing action. The powder and the resulting products of combustion (present in a heavy smoke cloud) are both non-toxic. However, it is desirable to remove the smoke because of its nuisance characteristics.

Operating Speeds

The use of iron-rich powder permits both scarfing and cutting operations. Hand-scarfing operations on stainless steel are carried out at a speed approximately one fourth to one third the speeds used on carbon steel with equivalent oxygen flows. The cutting of all types of stainless steel can be accomplished at cutting speeds comparable to equivalent thicknesses of carbon steel, but it is generally necessary to use a tip one size larger than that which would be used on carbon steel of the same thickness. Powder-flow requirements for cutting vary from ¼ to ½ lb per minute, depending upon the thickness of the material. Operating data obtained with powder hand-cutting tips are given in Table I, and characteristic cut surfaces are shown in Fig. 3. The quality of the cut surface approaches that obtained on carbon steel, although the surface is rougher, possibly because of selective oxidation of the various alloy components of the material.

An interesting feature of this process is that the high heat of combustion makes flying starts possible in both the scarfing and the cutting of cold steel. This factor eliminates the preheating time needed in carbon-steel cutting.

The apparatus required for powder-cutting or scarfing is relatively simple and inexpensive. The powder dispenser is essentially a pressure vessel with a powder ejector built into the bottom flange. It operates on a small flow of com-

Table I. Powder-Cutting Data on Clean 18-8 Stainless Steel

Thickness, In.	Tip Size	Cutting Oxygen, Psi	Powder Consumption, Lb per Hr	Cutting Speed In. per Minute
¼	4	50	15	24
½	6	50	18	20
1	6	50	18	15
2	8	50	18	11
4	10	50	18	7
6	12	50	22	5
8	14	65	24	4
10	16	65	24	4
12	20	75	30	4
14	20	75	45	3
16	24	75	45	3
18	24	75	45	2
20	24	75	45	2

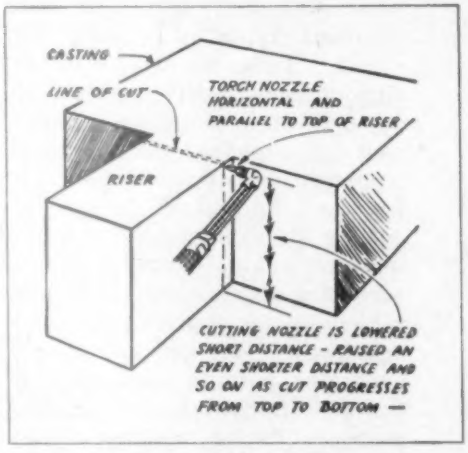

CASTING
LINE OF CUT
TORCH NOZZLE HORIZONTAL AND PARALLEL TO TOP OF RISER
RISER
CUTTING NOZZLE IS LOWERED SHORT DISTANCE - RAISED AN EVEN SHORTER DISTANCE AND SO ON AS CUT PROGRESSES FROM TOP TO BOTTOM —

Fig. 1—Sketch illustrating the oscillation technique used to cut stainless steel before the advent of powder

* Abstract of paper presented at the annual meeting, American Welding Society, Atlantic City, N. J., November 17–22, 1946.

pressed air through the dispenser, the powder being picked up by the air flow through the ejector and carried through ordinary rubber hose to the torch. The dispenser holds sufficient powder for at least eight hours of continuous operation. Single and triple outlet dispensers, a 44-in. scarfing torch and a 100-lb drum of powder are shown in Fig. 4.

For hand scarfing, a special torch 44 in. long is used. In addition to the usual oxygen and acetylene hoses, a third hose carrying the powder is connected to the torch from the powder dispenser. The powder passages are an integral part of the torch construction. The same general design is used for the hand-cutting torch, which is 28 in. long. Special powder-scarfing and powder-cutting tips are needed in conjunction with these torches. The same valve lever that actuates the cutting oxygen is also used to turn on the powder. The valves are so arranged that the powder comes on slightly before the cutting oxygen to further insure a flying start.

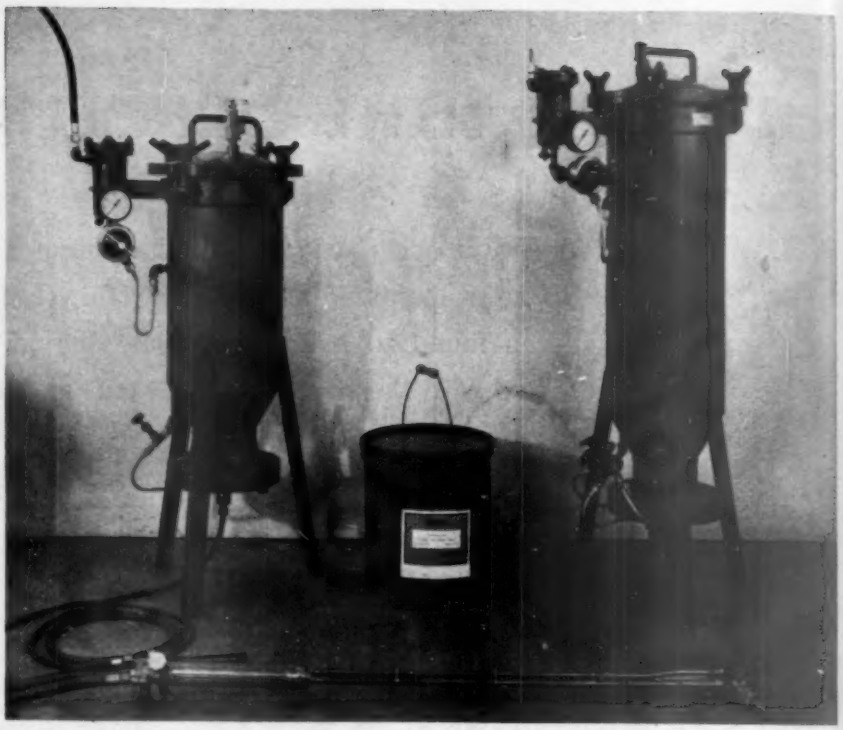


Fig. 4—Single and triple outlet dispensers, 100-lb drum of powder and 44-in. hand-scarfing torch. See Fig. 5 (page 66) for a machine-cutting tip

Machine-Cutting Torches

A series of four machine-cutting attachments have been made to fit standard types of cutting machines. These are capable of cutting stainless steel ranging from ⅛ to 26 in. in thickness. Thus a user of standard oxy-acetylene equipment can cut stainless steel by the addition of a powder-cutting attachment and a powder dispenser. Fig. 5 shows a tip-end view of a machine-cutting powder attachment as applied to a standard torch. This complete line of apparatus permits application of the powder-cutting and scarfing processes to the machine flame-cutting of stainless steel and special high-alloy and non-ferrous materials.

In the steel mill, the process finds its principal application in the conditioning of stainless steel and in cutting sections generally ranging from 3 to 24 or 26 in. in thickness. Large bloomed ingots, small unrolled ingots, slabs and billets are generally the type of work handled by powder-scarfing. In the case of the bloomed ingots, these are generally covered with severe cracks and corner tears that in some cases are as deep as 2 or 3 inches. By powder-scarfing, it is possible to condition an ingot of 12,000 lb in a matter of 4 to 6 hours, as contrasted with a possible 48 hours or more that would be required for grinding. The small unrolled ingots generally do not have any cracks but have a spongy surface, approximately 3/16 in. deep, that must be removed before a quality product can be rolled. It is possible to condition a heat of 22 to 24 1,000-lb ingots in one eight-hour turn by using two powder-scarfing torches. An ingot in the process of being scarfed is shown in Fig. 6.

In the scarfing of heavy slabs and billets, the same conditions apply as in the scarfing of small or bloomed ingots. In many cases, material of this type so badly cracked that it would be economically unfeasible to condition it by grinding can easily and quickly be reclaimed by the use of powder-scarfing. A good powder-scarfing job will produce a surface that is nearly equivalent to that of a carbon-steel scarfed surface, as shown on the 4-by-4-in. billets of Fig. 7.

The slag produced during the scarfing operation is of an entirely different character from that on carbon steel and is rather diffiult to remove when the material is hot. Upon cooling, however, the differential contraction between slag and base metal permits the former to be easily knocked off. On exceptionally tenacious spots the scale can be removed by flame-descaling.

The cutting process in the steel mill has found valuable use in the removal of hot tops from large ingots or bloomed ingots. The cutting speed on heavy sections from 14 to 26 in. thick averages approximately 2 in. per minute; it has been possible to remove the hot top from ingots 18 in. thick and 56 in. wide in 28 minutes. For this class of work, tips providing 2,000 to 2,500 cu ft of oxygen per hour are required, and an average of 30 to 40 lb per hr of powder is used. In spite of the heavy section, flying starts are obtained on this material.

Slabs that are rolled from ingots may often have very badly cracked edges, even when the flat surfaces are in reasonably good condition. The use of the powder-cutting process for removing cracked edges of slabs has resulted in the savings of thousands of dollars per week merely by making it easier to reclaim slabs that would otherwise be considered absolute scrap. Slabs are also cut into smaller sections

Fig. 6—Ingot in the process of being powder-scarfed

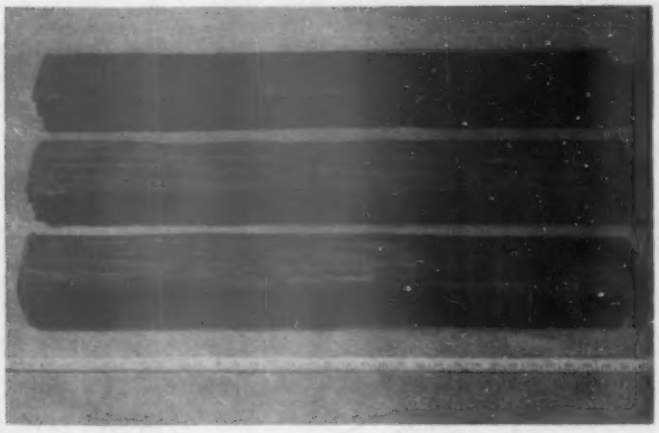


Fig. 7—High-quality scarfing on 4-by-4-in. billets

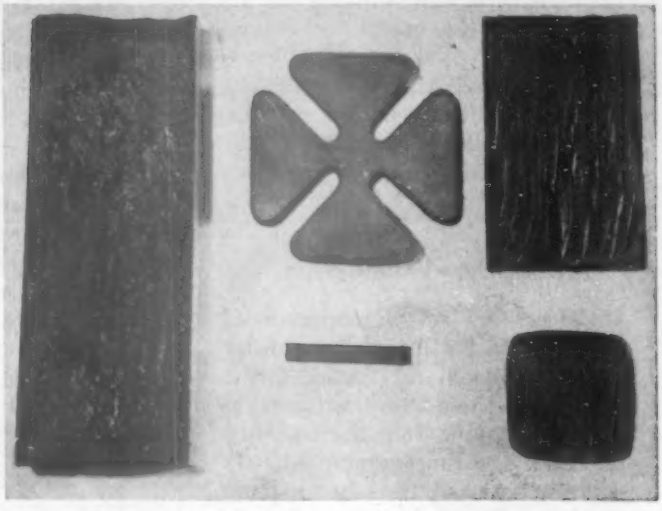


Fig. 3—Characteristic cut surfaces on various materials. The process is readily adapted to machine flame-cutting

for further rolling, as shown in Fig. 8. Medium-sized billets have been cut to short lengths. The billets are laid out on a bed, and the cutting proceeds from one billet to the next without stopping, just as though a solid slab were being cut. With a set-up of this type 115 stainless 18-8 billets, 3½ by 3½ in., were severed in approximately one hour.

A further use of the process in stainless-steel production is the cutting to size of relatively thin stainless plate (about 1 to 2 in. thick) to be made into "sandwiches" and then rolled into clad plate. Stainless plate can be cut to customers' actual specification sizes, which is something not generally done in steel mills because of the difficulty in cutting the material.

Certain scrapping operations present rather attractive possibilities for the powder-cutting process, the first one being the reduction of carbon-steel thimble butts or skulls to charging-box size. Ordinarily this is done by hand lancing, which is a laborious and time-consuming job. By using a large standard torch in connection with a powder-cutting attachment, it is possible to increase the scrapping speed on thimble butts by as much as four times. The powder is required because the thimble butts or skulls are coated with a heavy adherent layer of furnace slag. The injection of powder into the cutting-oxygen stream creates a sufficiently high-temperature reaction to melt away the adherent slag layer so that the cutting-oxygen stream can attack the underlying carbon steel in the conventional manner. Speeds of 1½ to 2 in. per minute on butt sections up to 30 in. thick have been obtained.

In the foundry, the process has found considerable application in the removal of stainless-steel risers that heretofore had been melted off by the carbon or metal arc. The cutting speed is nearly equivalent to that obtained on carbon-steel risers, but cutting oxygen consumptions are somewhat higher. A riser 6 in. in diameter can be removed by powder-cutting in a matter of 1½ minutes overall time, whereas the same riser removed by the carbon-arc method would require about 25 to 30 minutes of cutting time.

Production Riser Removal

When castings of one type are produced continuously, it is possible to mechanize the process with further savings, inasmuch as machine-cutting is always less expensive than hand cutting. This has been done in several instances, particularly on centrifugal castings of rotors and the like, where there

is a continuous internal ring that must be removed. An example is shown in Fig. 9. This ring diameter is approximately 30 in., and the material is 1¼ in. thick. The ring was removed in 10 minutes cutting time, while the previous method of cutting it out in a lathe took more than an hour.

The use of powder permits the cut to penetrate even to a metal body that is coated with a layer of refractory material. In the foundry the refractory material consists of sand, which frequently adheres in corners of the work. Thus a rigid cleaning technique prior to riser removal is not necessary with powder-cutting. This characteristic of the powder-cutting process will be useful in carbon-steel foundries for removal of risers prior to sandblasting, eliminating the extra tonnage of the risers that were previously attached to the castings while they were being cleaned.

Fig. 9—Machine powder-cutting. This riser is being cut from a centrifugal stainless-steel casting on a production basis. The ring is 30 in. in diam, and the material is 1¼-in. thick

Stainless Fabrication

Fabricators or warehousers of stainless steel will find the powder process particularly useful, for it will permit them to cut or fabricate sections heavier than the capacity of their shearing equipment. It will also speed up contour or shape cutting. For very thin stainless-steel plates, in the range up to ¼ in. thick, better edges will result if stack cutting is employed, as shown in Fig. 10. Because of the high heat reaction, it is not necessary to clamp the plates tightly as the reaction will jump over any ordinary gaps. All plates below the top will have extremely sharp edges. Beveled edges for welding are as easily produced as square cuts.

The question will be asked as to the effect of powder-cutting on the metallurgical qualities of the material. If the stainless steel is of the hardenable variety, that is of the 400 series, naturally hardening of the cut surface will result. The same procedures that are followed to prevent cracking on low-alloy steel plate will have to be followed here. As far as corrosion resistance on unstabilized material is concerned, a small amount of carbide precipitation has been noted at a depth of ¼ in. from the cut surface; that is in the region where the temperature gradient was between 1,000 and 1,500 F, the critical temperature range for this material. Powder-cut areas on unstabilized stainless from which scale and fused metal have been removed will satisfactorily withstand any service in which the as-welded steel gives satisfactory performance. Columbium or titanium stabilized steels are no more affected by powder-cutting than they are by welding. Powder-cut or scarfed surfaces which are to be subsequently rolled or forged require no special treatment inasmuch as the subsequent heating operations will put the material in its original condition.

Cast Iron and High Alloys

Cast iron requires a specialized oscillation technique in cutting with standard oxy-acetylene equipment because of the presence of graphite flakes. With powder, it is possible to cut cast iron as easily as stainless steel. For any given thickness the oxygen and powder-flow requirements are roughly equivalent to the stainless-steel figures, but the cutting speed is reduced approximately 50%. To date the process has been used most extensively in a large cast

(continued on page 113)

Fig. 10—Stack-cutting twelve 10-gauge sheets of 304 stainless for chemical equipment. Only two C-clamps and a piece of steel slab were required to hold the stack

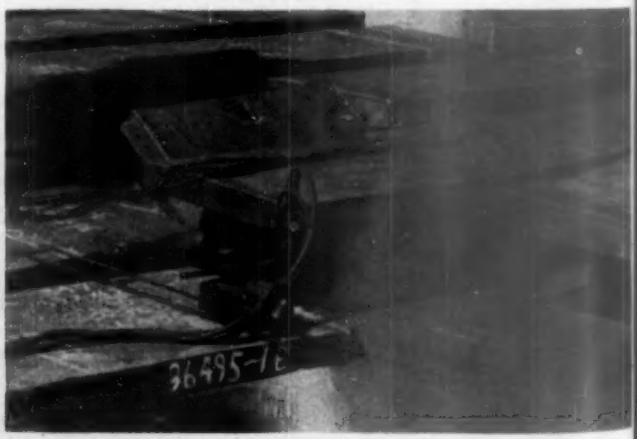


Fig. 8—Steel mill cutting operations on 18-8 stainless slabs 4 to 7 in. thick. The slabs are cut to smaller sizes before they are rolled to the finished thickness

Cast Iron *Welded to* Steel

BY DONN BORING

Rightfully proud of their ability to deliver the goods are Weldor Art Medynski and his helper H. Deslaurier, who are shown here standing beside the finished radiator

VAPOUR Car Heating Co., Montreal, Canada, which specializes in the manufacture of fin-type radiators for commercial and domestic heating, recently received an order for 24 radiators with 3-high headers. Ordinarily, this order would have been mere routine, but, as luck would have it, the supply of three-high headers was completely exhausted. Furthermore, the foundries were overloaded so that no more headers could be procured without a delay of several months. The solution was found in welding.

First of all, four-high headers were taken from stock and cut down to the correct size on a band saw. A 3/16-in. thick steel plate was then fitted to the cast-iron header and welded in place with aluminum-bronze electrodes. Neither preheating nor postweld heat treatment was given. A hydraulic pressure test of 300 psi showed that all welds were sound.

This application is typical of many that have been found for aluminum-bronze electrodes. Other combinations of dissimilar metals which have been successfully welded include steel or cast iron to bronze, brass to copper, bronze to nickel alloys. In addition these versatile electrodes are used to provide a high-strength bronze overlay on valve seats and on steel for bearings. Further applications have been found in combating corrosion from salt water and commercial acids and in overlaying forming and drawing dies.

The sawed-off cast-iron header was placed in a vise, and a 3/16-in. steel end plate was welded to it, using aluminum-bronze electrodes

The finished three-high header upon completion of the welding

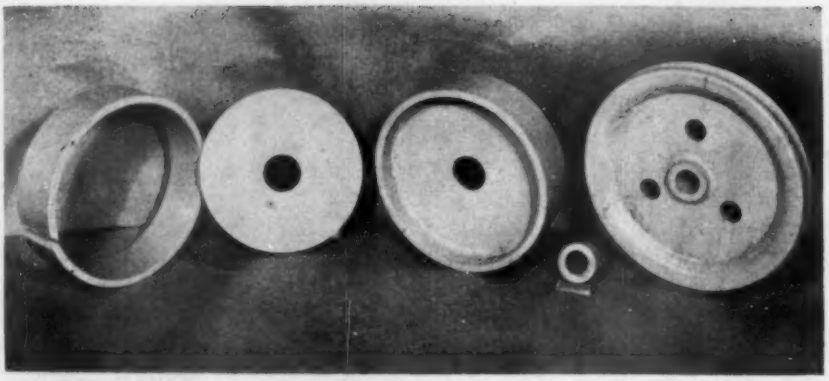


Fig. 1—On the left is the formed rim of a 15-in-diameter sheave. Next is the web and then the web and flat rim welded together. The hub, a drilled 2½-in. round, is shown by itself and as added to the rim-web assembly

All-Welded Sheaves

BY T. W. LING

CONTRACTORS, shipbuilders, oil-field construction crews and many others who use wire rope have been looking forward to a fabricated sheave that is able to withstand the rigors of the service imposed upon such equipment. They will find the answer in a new sheave of welded construction now being manufactured by Sherman & Reilly, Inc., Chattanooga, Tenn.

This weld-fabricated sheave is a wartime development, used by the government for rigging. Reports are that it was preferred two to one over the cast-steel sheave previously used. Contractors like it because it will stand being run over by a truck, dropped or kicked around and still give faithful service.

The manner in which this fabricated sheave is built is rather simple. Only three pieces of steel are required. These are shown in Fig. 1. On the left is the rim for a sheave of 15-in. diameter; this is made from a piece of flat bar stock ½ by 4 in. Next we see the web, a disc cut from a piece of ⅜-in. plate, and then the two assembled. The hub is merely a piece of 2½-in. round which has been drilled to receive a bushing of the desired size.

These three components are welded together in the same manner as one might assemble a fabricated wheel or gear from a hub, web and rim. After welding has been completed, the flat rim is heated in order to form the groove for the wire rope. The forming operation consists merely of bending each edge of the rim in a "bulldozer"* to make a U-shaped groove. It is possible to form the groove so accurately that subsequent machining will not be required. How the sheave looks when bushed and ready for service is shown in Fig. 2.

* A bulldozer is a horizontal-type bending press used for forging operations and other heavy jobs. See THE WELDING ENGINEER, "Welded Cranes and Heavy Machinery," page 53, May, 1946.

Fig. 2—The completed sheave with the hub bushing in place. The groove for the rope was formed by heating and bending the flat rim after welding had been completed

STAINLESS-STEEL KETTLES

(continued from page 43)

and the steam inlet. The kettle is then given a final hydrostatic test to make sure that no careless weldor has burned through the jacket wall in adding the final fittings. The safety valve is screwed into place, and the finished kettle (Fig. 11) is ready to be crated for shipment.

The description given above applies, of course, to only one type of kettle, but the operations are much the same on the other members of the Groen line. Arc welding is used almost exclusively with a single exception—the cylindrical housing for the steam-generating (gas and electric heated) kettle. This longitudinal seam is tacked on a spot welder since it does not have to be pressuretight.

Oxy-acetylene welding is not used at all for kettle manufacture, but the equipment is kept on hand for maintenance repairs and to fabricate special tools as they are required.

Automatic welding has been tried but so far without very good results. A different type of welding head will be tried out soon, the writer is informed by Vice-President Fred H. Groen, Jr. Mr. Groen believes that at least the outer seams of the larger kettles can be welded automatically.

The company has eight arc welders, all d-c motor-generator sets. Seven of these are in service during the day, eight at night. The day and night shifts together employ a total of 85 men and turn out approximately 20 kettles daily. During the war a production of as high as 40 kettles a day was attained, but these were all of one type for large Navy orders. Peacetime production is more difficult because many different sizes and types of kettles must be worked upon simultaneously.

The company is proud of its product and justifiably so. "Almost any metalsmith can fashion a kettle under the guidance of a set of blueprints," says Mr. Groen, "but it takes more than mere drawings and skill with tools to achieve the know-how and know-why responsible for the differences that distinguish our kettles."

Decimal Equivalents

for Fractional Parts of a Foot

1/2's	1/4's	1/8's	1/16's	1/32's	1/64's	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"
					0	.0000	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
					1	.0013	.0846	.1680	.2513	.3346	.4180	.5013	.5846	.6680	.7513	.8346	.9180
				1	2	.0026	.0859	.1693	.2526	.3359	.4193	.5026	.5859	.6693	.7526	.8359	.9193
					3	.0039	.0872	.1706	.2539	.3372	.4206	.5039	.5872	.6706	.7539	.8372	.9206
			1	2	4	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219
					5	.0065	.0898	.1732	.2565	.3398	.4232	.5065	.5898	.6732	.7565	.8398	.9232
				3	6	.0078	.0911	.1745	.2578	.3411	.4245	.5078	.5911	.6745	.7578	.8411	.9245
					7	.0091	.0924	.1758	.2591	.3424	.4258	.5091	.5924	.6758	.7591	.8424	.9258
		1	2	4	8	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271
					9	.0117	.0951	.1784	.2617	.3451	.4284	.5117	.5951	.6784	.7617	.8451	.9284
				5		.0130	.0964	.1797	.2630	.3464	.4297	.5130	.5964	.6797	.7630	.8464	.9297
					11	.0143	.0977	.1810	.2643	.3477	.4310	.5143	.5977	.6810	.7643	.8477	.9310
			3	6		.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323
					13	.0169	.1003	.1836	.2669	.3503	.4336	.5169	.6003	.6836	.7669	.8503	.9336
				7		.0182	.1016	.1849	.2682	.3516	.4349	.5182	.6016	.6849	.7682	.8516	.9349
					15	.0195	.1029	.1862	.2695	.3529	.4362	.5195	.6029	.6862	.7695	.8529	.9362
	1	2	4	8		.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
					17	.0221	.1055	.1888	.2721	.3555	.4388	.5221	.6055	.6888	.7721	.8555	.9388
				9		.0234	.1068	.1901	.2734	.3568	.4401	.5234	.6068	.6901	.7734	.8568	.9401
					19	.0247	.1081	.1914	.2747	.3581	.4414	.5247	.6081	.6914	.7747	.8581	.9414
			5	10		.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427
					21	.0273	.1107	.1940	.2773	.3607	.4440	.5273	.6107	.6940	.7773	.8607	.9440
				11		.0286	.1120	.1953	.2786	.3620	.4453	.5286	.6120	.6953	.7786	.8620	.9453
					23	.0299	.1133	.1966	.2799	.3633	.4466	.5299	.6133	.6966	.7799	.8633	.9466
		3	6	12		.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479
					25	.0326	.1159	.1992	.2826	.3659	.4492	.5326	.6159	.6992	.7826	.8659	.9492
				13		.0339	.1172	.2005	.2839	.3672	.4505	.5339	.6172	.7005	.7839	.8672	.9505
					27	.0352	.1185	.2018	.2852	.3685	.4518	.5352	.6185	.7018	.7852	.8685	.9518
			7	14		.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531
					29	.0378	.1211	.2044	.2878	.3711	.4544	.5378	.6211	.7044	.7878	.8711	.9544
				15		.0391	.1224	.2057	.2891	.3724	.4557	.5391	.6224	.7057	.7891	.8724	.9557
					31	.0404	.1237	.2070	.2904	.3737	.4570	.5404	.6237	.7070	.7904	.8737	.9570
1	2	4	8	16		.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
					33	.0430	.1263	.2096	.2930	.3763	.4596	.5430	.6263	.7096	.7930	.8763	.9596
				17		.0443	.1276	.2109	.2943	.3776	.4609	.5443	.6276	.7109	.7943	.8776	.9609
					35	.0456	.1289	.2122	.2956	.3789	.4622	.5456	.6289	.7122	.7956	.8789	.9622
			9	18		.0469	.1302	.2135	.2969	.3802	.4635	.5469	.6302	.7135	.7969	.8802	.9635
					37	.0482	.1315	.2148	.2982	.3815	.4648	.5482	.6315	.7148	.7982	.8815	.9648
				19		.0495	.1328	.2161	.2995	.3828	.4661	.5495	.6328	.7161	.7995	.8828	.9661
					39	.0508	.1341	.2174	.3008	.3841	.4674	.5508	.6341	.7174	.8008	.8841	.9674
		5	10	20		.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
					41	.0534	.1367	.2201	.3034	.3867	.4701	.5534	.6367	.7201	.8034	.8867	.9701
				21		.0547	.1380	.2214	.3047	.3880	.4714	.5547	.6380	.7214	.8047	.8880	.9714
					43	.0560	.1393	.2227	.3060	.3893	.4727	.5560	.6393	.7227	.8060	.8893	.9727
			11	22		.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740
					45	.0586	.1419	.2253	.3086	.3919	.4753	.5586	.6419	.7253	.8086	.8919	.9753
				23		.0599	.1432	.2266	.3099	.3932	.4766	.5599	.6432	.7266	.8099	.8932	.9766
					47	.0612	.1445	.2279	.3112	.3945	.4779	.5612	.6445	.7279	.8112	.8945	.9779
	3	6	12	24		.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
					49	.0638	.1471	.2305	.3138	.3971	.4805	.5638	.6471	.7305	.8138	.8971	.9805
				25		.0651	.1484	.2318	.3151	.3984	.4818	.5651	.6484	.7318	.8151	.8984	.9818
					51	.0664	.1497	.2331	.3164	.3997	.4831	.5664	.6497	.7331	.8164	.8997	.9831
			13	26		.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844
					53	.0690	.1523	.2357	.3190	.4023	.4857	.5690	.6523	.7357	.8190	.9023	.9857
				27		.0703	.1536	.2370	.3203	.4036	.4870	.5703	.6536	.7370	.8203	.9036	.9870
					55	.0716	.1549	.2383	.3216	.4049	.4883	.5716	.6549	.7383	.8216	.9049	.9883
		7	14	28		.0729	.1563	.2396	.3229	.4063	.4896	.5729	.6563	.7396	.8229	.9063	.9896
					57	.0742	.1576	.2409	.3242	.4076	.4909	.5742	.6576	.7409	.8242	.9076	.9909
				29		.0755	.1589	.2422	.3255	.4089	.4922	.5755	.6589	.7422	.8255	.9089	.9922
					59	.0768	.1602	.2435	.3268	.4102	.4935	.5768	.6602	.7435	.8268	.9102	.9935
			15	30		.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948
					61	.0794	.1628	.2461	.3294	.4128	.4961	.5794	.6628	.7461	.8294	.9128	.9961
				31		.0807	.1641	.2474	.3307	.4141	.4974	.5807	.6641	.7474	.8307	.9141	.9974
					63	.0820	.1654	.2487	.3320	.4154	.4987	.5820	.6654	.7487	.8320	.9154	.9987

PAGE *Welding* ELECTRODES

This is the latest PAGE announcement

For further information see your PAGE Distributor

PAGE NI-CAST SHIELDED ARC ELECTRODES

Will Produce Good Machinable Welds On All Types Cast Iron. Useful for Repairing Broken, Worn or Defective Castings.

MONESSEN, PA.—The soft weld metal deposited by this new PAGE electrode bonds perfectly with all grades of cast iron. This makes it invaluable for repairing broken, worn or defective castings, and for correcting errors made in machining. After machining or grinding, the weld metal deposit closely matches the color of the cast iron parent metal.

The core wire is 99% nickel. The coating is free of fluorides and other ingredients which generate injurious gases.

These new PAGE Ni-Cast Shielded Arc Electrodes are made in 3/32″, 1/8″, 5/32″ and 3/16″ diameters. They are packed in 10-pound cartons.

Announcement Number Nine

This is the latest of nine announcements made by PAGE *in the past twelve months. For information about* PAGE *welding electrodes or gas rods or about their most efficient use, get in touch with your* PAGE *distributor.*

ACCO

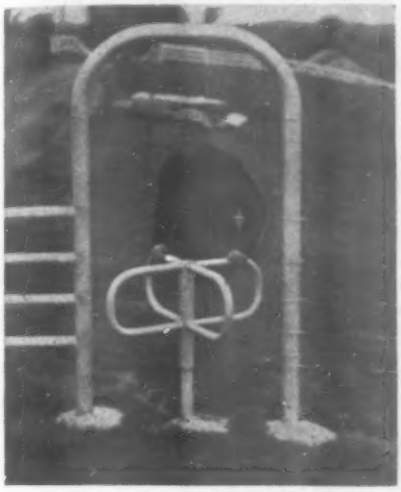
Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Welded Turnstile Gate

VERN WATSON, Sylvia Sunset Farms, Annandale, Minn., built this attractive turnstile gate by bending and welding pipe members. The arch over the turnstile was formed of 3-in. pipe and



Courtesy The Lincoln Electric Co.

Vern Watson and his welded turnstile gate

butt welded to the two 3-in. uprights. The four horizontal rails on the left are sections of 2½-in. pipe; the ends were cut to fit the contour of the larger pipe and were then fillet welded all around. The four intersecting loops of the turnstile were formed of 2-in. pipe and welded to an upright sleeve of 2½-in. pipe; the ends of the 2-in. pipe were also cut to the contour of the larger pipe before welding.

The 2½-in. sleeve fits loosely over a vertical 2-in. pipe to permit the gate to be turned; the turnstile post is embedded in a concrete foundation, as are the 3-in. upright members of the arch.

* *

New Tank from Old Iron

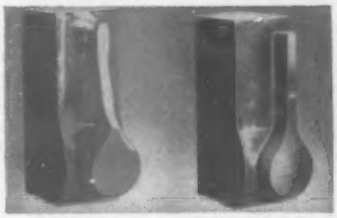
Two wrought-iron storage tanks which had served for more than 50 years in the Findlay field of the Ohio Oil Co., *after* having been moved to Ohio from Pennsylvania, were recently purchased by the Dow Chemical Co. and dismantled under the guidance of the Austin Co., Midland, Mich. The plates cut from these veterans of oil storage were shipped to Marysville, Mich., to be used in the construction of a new all-welded tank.

The two old tanks were each approximately 85 ft in diameter and from 25 to 27 ft in shell height. They are believed to have been of 7-ring construction, 35,000 bbl capacity, when first used, but the top seventh ring was removed during the shipment from Ohio in the booming 1890's. Shell thicknesses ranged from ¼ to ⅜ in. plate.

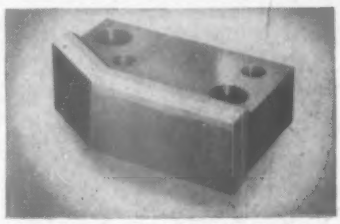
The old plates did not show any appreciable corrosion, although it had been so long since the last painting that it was difficult to find any trace of paint remaining on the metal surface. The bottoms, apparently, had never been painted.

THE PIONEERS of tool and die WELDING ELECTRODES

. . . can help you save 4 ways



Die unit quickly repaired by welding with Eureka Electrodes. No heat-treat required.



Die unit compositely fabricated with Eureka Electrodes. No heat-treat necessary.

Save many man hours, conserve valuable tools and dies and minimize production delays with the aid of EUREKA TOOL and DIE WELDING ELECTRODES. Here's how it can be done:

1 REPAIRING DIES. . . . Existing units that may fail in operation can be EUREKA welded, either partially or wholly, resulting in a minimum of "down-time."

2 COMPOSITE FABRICATING. . . . Die units can be compositely fabricated, when practical, by EUREKA welding, resulting in numerous advantages.

3 CORRECTING DESIGN. . . . EUREKA welding facilitates making changes in contour, corners or edges during die "try-out" or "change-over" periods.

4 RECTIFYING ERRORS. . . . EUREKA welding permits the correction of errors made in tool and die manufacturing, resulting in great savings.

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New Products to Use

Greyhound's new farm welder meets NEMA and REA specifications

Farm Welder

CONFORMING to NEMA and REA requirements is a portable 3-kva a-c arc welder for use on the farm, garage and welding shops. It has a built-in power factor correction, and a hand wheel provides for a continuous range of current settings. This welder is available in 130 and 180 amp capacities, with or without power factor correction. Accessories include: 15 ft of electrode cable, 10 ft of ground cable, 8 ft of 3-wire power cable, a head shield with protective lens and cover glass, an electrode holder and a package of assorted welding electrodes. GREYHOUND A. C. ARC WELDER CORP., 604–606 Johnson Ave., Brooklyn 6.

* *

Insulation Stripper

THE "Hot Blade" wire stripper employs two electrically heated stripping blades for continuous production stripping. It will remove cotton, silk, plastic or rubber insulation from conductors of either the fine stranded or solid types without cutting the strands or injuring the wire in any way. To operate, the wire is inserted between the heat-resistant blades, and the foot pedal is depressed. Two parallel grooves are burned through the insulation down to the conductor; a slight twist completes the groove, and a pull removes the insulation. Each blade has an individual heat control and a transformer to permit the burning temperature to be raised or lowered as required for the particular piece. Ideal INDUSTRIES, INC., 1935 Park Ave., Sycamore, Ill.

Welding Goggles

MOUNTED on an adjustable plastic headgear, this new welding goggle can be shifted with a quick flip of one hand from the eyes to the forehead. The operator simply pulls the goggles slightly forward, then releases them. Goggle cups, adjustable to individual facial requirements, are attached to the headgear and controlled by coil springs. These springs are mild enough to eliminate pressure, yet are strong enough to hold the goggles firmly in place. Prescription glasses may be worn under the new "Speed-Shift" goggles. CHICAGO EYE SHIELD CO., 2300 Warren Blvd., Chicago 12.

"Speed-Shift" goggles may be raised with one hand for rapid inspection

* *

R-W Controls

A LINE of non-synchronous electronic resisting-welding control combinations includes ignitron contactors and sequence-weld timers (with or without electronic heat control) mounted in a single cabinet. The cabinet, designed for right-hand side mounting, can be placed on the floor alongside the welding machine or mounted on a wall or balcony. The sequence-weld timers give accurate timing regardless of voltage variations because voltage-regulation tubes are included in the timing circuit. Use of industrial-type relays, cabled wiring and a plug-in timing panel and accessories simplifies servicing and increases flexibility. GENERAL ELECTRIC CO., APPARATUS DEPT., Schenectady 5, N. Y.

* *

Hand Vise

AN aluminum hand vise, "Palmgren No. 15," which grips solidly without marring or scratching the work is offered for handling of small parts and pieces in both repair and production jobs. It is only 7 oz in weight and 5 in. long; its jaws are 1⅛ in. wide and open to 1½ in. CHICAGO TOOL AND ENGINEERING CO., 8383 S. Chicago Ave., Chicago 17.

One of Sciaky's new flash welders for the welding of aluminum and steel

Flash Welders

A NEW flash-welder line ranges in size from 75 to 500 kva. The smallest size will weld mild-steel cross-sections up to 0.90 sq in. in area, while the larger will handle up to 5 sq in. Included are miter joint welders for improved production of steel and aluminum window frames, door sashes, etc. Among design features are frames built as a self-contained beam, conductors from transformer to dies outside the frame, a rigid T-shaped bed with a narrow guiding key for platens, clamps actuated by a booster-supplied hydraulic system, flashing and upsetting independently controlled on the large power-operated machines.

Both platens are moved by an air cylinder driving a wedge-shaped cam between rollers. Heavy-duty machines can be equipped with synchronous timing control, postheat current and phase-shift heat control to permit welding of aluminum alloys, high-carbon and aircraft steels. SCIAKY BROS., INC., 4915 W. 67th St., Chicago.

* *

High-Carbon Electrode

"FABRIALLOY," a fully shielded high-carbon electrode (with other alloys added) is offered for building up worn surfaces preparatory to hard-facing. It is said to be free flowing with either alternating in direct current and to give a build-up of 0.50–0.60% carbon steel without spatter loss, porosity or inclusions. It is also recommended for bonding with manganese-alloy steels. Available in 14-in. length and diameters of ⅛, 5/32, 3/16 and ¼ in. INDUSTRIAL OVERLAY METALS CORP., 422 S. Michigan Ave., Chicago 1.

* *

Hand-Operated Grinder

MODEL GH, a hand-operated surface grinder, is designed for precision grinding in the tool room. It has a precision elevating screw and a cross-feed screw that operate through 4-in. bronze nuts to minimize wear. The hand wheel for the spindle elevating screw is graduated in half thousandths with vernier adjustment to 0.0001 in. The same graduation and vernier adjustments are provided for the cross-feed hand wheel. The working area of the table is 6½-in by 19¾-in, and maximum work height is 12 in. It uses the standard 7 by ½ by 1¼ in. grinding wheel. THE DOALL CO., Des Plaines, Ill.

Your Weldors Will Want THIS NEW FREE BOOKLET

AUTHENTIC INFORMATION ON ALL PHASES OF WELD CLEANING

"How to Clean Welds" teaches weldors thorough methods of weld cleaning which will improve their workmanship and reduce your costs. Many short-cuts that save time and help prevent mistakes are offered in this 16-page illustrated booklet. Send today for as many free copies as you need—use the handy coupon below!

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THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
247 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

Welding torch with handle-length lever and "Gasaver" increases production up to 100%

Welding Torch

A NEW welding torch, model W-46," incorporates a handle-length lever which makes it possible to shut off or release gas with finger-tip pressure. This is combined with a built-in automatic "Gasaver" said to eliminate ¾ of the gas waste ordinarily encountered. Manufacturer states that tests under ordinary working conditions show a saving of $4.80 per man per day, and that plants using the W-46 report their production has increased 100% or more. WELDIT INC., 994 Oakman Blvd., Detroit 6.

* *

Welder with Current Booster

A NEW "Fleet-Arc" a-c welder is equipped with an arc booster which increases the current the instant the arc is struck. The arc is thus started automatically the moment the electrode touches the work, without the use of high-frequency devices or higher voltages.

"Fleet-Arc" a-c welder is said to duplicate the flexibility of d-c welder output

A selector switch on the front of the welder governs the amount of booster current to be used in striking the arc and provides a range of striking intensity to suit the varied requirements encountered in the welding of thin sheets or heavy plates, making tack welds, in the use of various types and sizes of electrodes, etc. Amperage is indicated on a calibrated dial on the face of the welder. A thermostatic control opens the magnetic starter when overloaded, permitting sustained welding at high-current values with complete protection to the operator. This unit is made in 200,300 and 500 amp sizes. Both frame and housing are of all-welded construction. LINCOLN ELECTRIC CO., INC., Cleveland 1.

Butt welder will handle mild steel wire or rods up to 5/16-in. diameter.

Butt Welder

A NEW butt welder operating from a 110-volt source has a capacity for welding mild steel wire or rods up to 5/16 in. diameter. Spring-controlled adjustable clamps secure the pieces to be welded, and the welds can be made as quickly as the unit can be loaded. REX WELDER & ENGINEERING CO., 7 E. 19th St., Kansas City, Mo.

* *

Automatic-Welding Wires

THE Una line of automatic-welding wires and tapes is now being distributed by WILSON WELDER AND METALS CO., INC., 60 E. 42nd St., New York City 17. Five knurled-type wires in several diameters and five flux-impregnated tapes comprise the present line. The wires may be used either separately or in conjunction with the tapes. Applications range from thin-gauge sheet-metal forms to axle housings, boilers, torque tubes, etc.

* *

Shear Control

CONTROL of "Steelweld" shears has been made easier by a new safety foot switch, connected to an outlet at the front of the machine by a heavy cable that controls the movement of the blade. The switch requires only a slight movement of the toe and can be slid around the floor to wherever it is most convenient to use. Thus the operator can stand several feet away from the front of the machine, a convenience when cutting long sheets. THE CLEVELAND CRANE & ENGINEERING CO., Wickliffe, O.

* *

Chip Guard

"STASAFE" chip guard, adaptable to lathes and grinding wheels, gives continuous protection from flying particles and oil without obstructing inspection or vision at the point of operation. It consists of an all-metal frame, a replaceable curved plastic window and a universal attachment on the base designed to set the guard at any desired angle or to move it laterally when in place on a machine. THE STANDARD SAFETY EQUIPMENT CO., 232 W. Ontario St., Chicago 10.

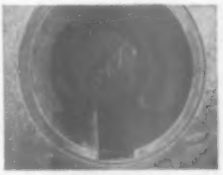
Doubling in Brass

Phos-Trode

Shielded-Arc Phosphor Bronze Electrodes

do two jobs — provide an excellent bond with brass, and an excellent deposit for resistance to salt water corrosion

Defective material in the old key-way was chipped out. Then, the entire area was filled in, flush with the inside bore, with Phos-trode weld metal. The dense Phos-trode deposit was easily machined to proper size.



The finished job: A new key-way was cut opposite the welded repair, and the huge brass casting was saved.

Salvaging this giant brass naval propeller with Phos-trode represents a saving of many thousands of dollars.

Phos-trode is Ampco's new Phosphor Bronze Electrode. It is becoming increasingly popular throughout industry — not only because it is ideal for welding cast iron, steel, bronze, or brass, but also because it often eliminates the need for large capital expenditures by permitting satisfactory repairs instead of costly replacements.

Phos-trode is easy to manipulate in all positions; its dense, pit-free deposits require less peening; its higher deposition rates, its greater efficiency, and its reduction of operator fatigue result in over-all economy. Get all the facts from your nearest Ampco weldrod distributor.

Write for latest bulletins.

AMPCO

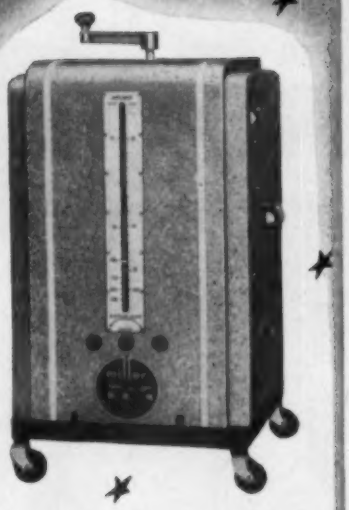
Phos-trode is a product of AMPCO METAL, INC.

AMPCO METAL, INC.

Department WE-2 Milwaukee 4, Wisconsin

W-96

ONCE IN A BLUE MOON...



★ Once in a blue moon the boys in the shop get a piece of equipment to which they give instant approval. The Miller A.C. Welder is just that kind of machine!

The only way to know real welding pleasure is to grab hold of the electrode holder on a Miller and strike an arc. Try it! See how easily the arc is established. Feel the steady, even, sure arc. Watch the metal being deposited faster.

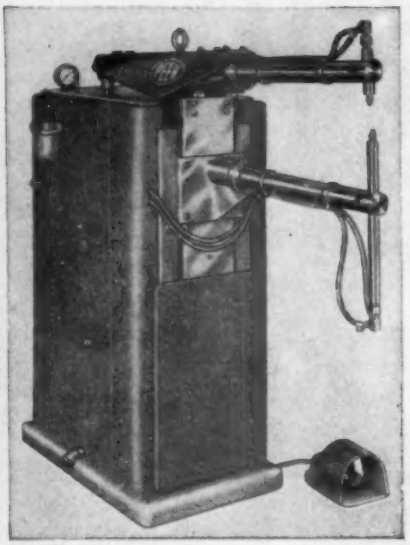
Once you have "run a bead" with a Miller A.C. Welder you know you have found that "once in a blue moon" piece of equipment.

Ten different models and sizes—all emphasizing Continuous Current-Arc Stability-Safety-Speed and Efficiency.

Stop at your jobber's store—try the Miller. Write for full information.

Miller AC Welders

MILLER ELECTRIC MANUFACTURING CO
APPLETON, WISCONSIN



One of the A-200 series air-operated rocker arm spot welders, 10 and 15 kva

Air-Operated Spot Welder

A NEW series of rocker-arm spot welders (A-200) incorporates in each model double-acting air cylinder, foot switch control, air pressure regulator, universal horns, water-cooled electrode holders and one set of straight and offset copper alloy welding tips. Lightweight welded steel construction of the rocker arm assembly is said to minimize hammering of the electrodes. Welder capacities are 10 and 15 kva; throat depths are 8, 12, 18, 24 and 30 in. PIER EQUIPMENT MFG. Co., Milton and Cross Sts., Benton Harbor, Mich.

★ ★

Silver-Brazing Alloy

AVAILABLE in rod, wire, strip and powder form, the new low-melting-point alloy, "EutecRod 1801," is said to provide high-strength brazes on both ferrous and non-ferrous metals. It may be applied by torch or used with furnace or induction-heating equipment. Melting at 1,143 F, it bonds at base-metal temperatures of 940–1,120 F and will flow readily into close-fitting joints because of its high capillary action. Weld deposits have a shear strength of 120,000 psi as well as good corrosion resistance and good electrical conductivity, states manufacturer. EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York City 13.

★ ★

Bench Grinder

A 6-in. heavy-duty bench grinder is offered for such operations as grinding surfaces, sharpening tools, wire brushing and buffing. Housings of die-cast zinc and steel wheel guards and covers meet all safety requirements. Adjustable U-shaped toolrests fit around the grinding wheel for the support of tools being sharpened, and a machined hole is provided on the face of the grinder base for mounting attachments used on bench grinders. The unit can be bolted to a bench or mounted on a pedestal that can be spotted anywhere in the shop. BLACK & DECKER MFG. Co., Towson 4, Md.

High Yield? yes
Uniformity? yes

A tested carbide . . meeting International and Federal specifications . . generating acetylene in 12 countries. Standard sizes in 100-lb. and 500-lb. drums. Location of our plant at Portland, Oregon permits low-cost delivery to all deep-water ports. Address:

Pacific Carbide & Alloys Co.
(Subsidiary of Stuart Oxygen Co.)
351 California Street
SAN FRANCISCO 4

IMPORTANT: These companies are not connected with any other producers of Carbide.

This spot welder provides for a maximum of sixty guns which operate in sequence

Multiple Spot Welder

"PROGRESS-O-MATIC" is the name of a new air-driven multiple spot welder that incorporates various welding guns for joining different thicknesses of metal, requiring variable times, heat and speeds. Basic components of the unit are: (1) a housing having sixty ports—one each for a possible maximum of sixty guns; (2) rotating disk which uncovers the various ports in sequence; (3) "Geneva" drive to this disk which allows a dwell of the disk at each port; (4) air motor which drives the disk through the Geneva drive; and (5) a drum containing eight cams and connected directly to the disk. Four cams control air flow to the air motor, and the other four operate switches to select the heat desired for each weld. Two air cylinders are provided for each gun: one to apply welding pressure, the other to close the circuit.

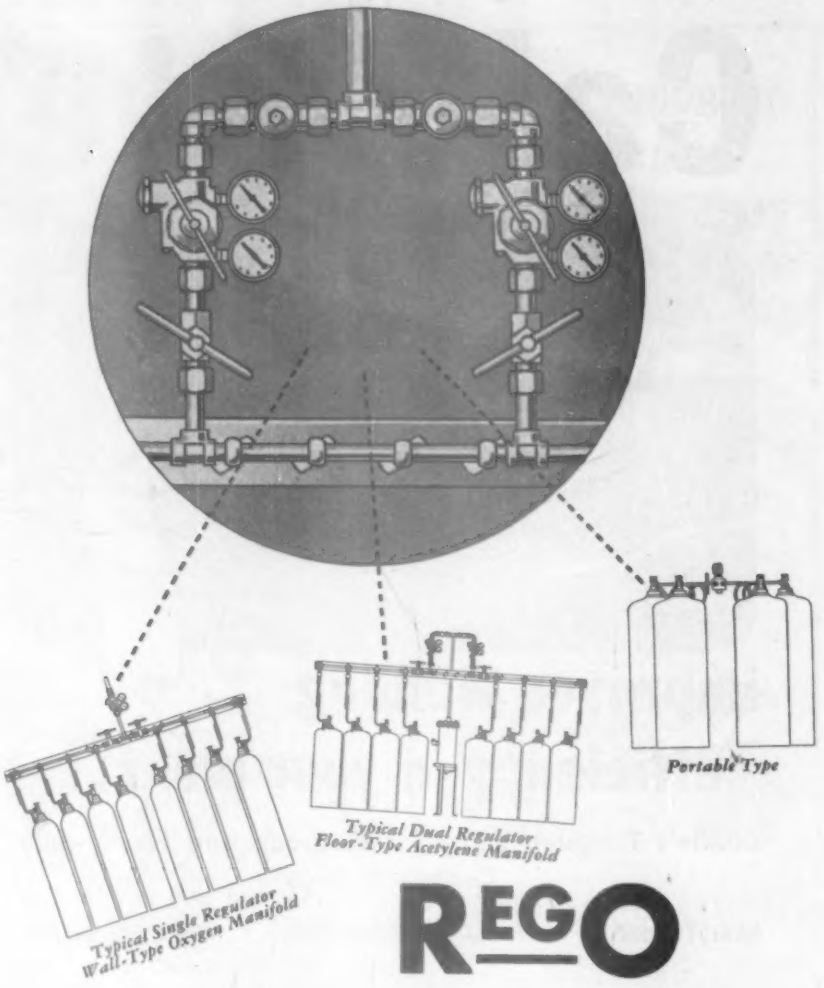
The combination of the many features of the unit makes possible rapid cycling from gun to gun as well as accurate control for each gun. All of the cylinders are interconnected so that every electrode is brought into contact with the work and welding pressure applied before the first weld is made. More guns may be added by drilling a single mounting hole for each. PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12.

* *

Pneumatic Hammer

THIS 3½-lb air-controlled hammer (model G) is recommended for scaling and peening welds, chipping operations, die work, ripping light-gauge sheet metal, chisel work, tuck pointing, etc. Its knurled body provides a firm grip, and the locking-type tool holder eliminates the danger of tools flying or falling out. BORM MFG. CO., Elgin, Ill.

Pneumatic hammer for weld cleaning, peening and general maintenance


Typical Single Regulator Wall-Type Oxygen Manifold
Typical Dual Regulator Floor-Type Acetylene Manifold
Portable Type

REGO

CONSTRUCTION

Produces Better Manifolds

● RegO design means safe performance, long life and low maintenance costs. Here are some of the construction features you get when you specify RegO Manifolds...

Unit Construction...The header section of each RegO Manifold is virtually one-piece; extra-heavy seamless brass pipe is run through the forged brass header fittings, the cylinder station shut-off valves and the master shut-off valves . . . all permanent connections are then silver-brazed. The header assembly is bolted to a heavy steel I-beam to assure permanent alignment.

Precision Regulation... large capacity two-stage RegOlators assure constant and uniform delivery pressure to the pipe system.

Extra Convenience... standard RegO Manifold construction provides individual shut-off valves at each cylinder station . . . this design permits any one cylinder to be disconnected without shutting down the entire manifold. Master shut-off valves control each main branch.

Rigid Tests . . . header pipe, valve bodies and fittings withstand pressure up to 10,000 psi and each complete RegO Manifold is subjected to a sustained air pressure test of up to 2,000 psi.

There Is A RegO Manifold to Fit Your Most Exacting Requirements

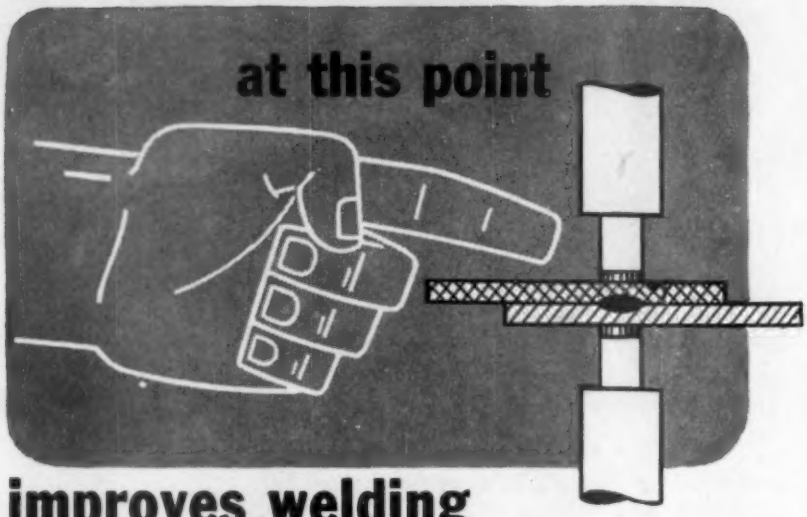
REGO MANIFOLDS *for* Oxygen • Acetylene • Hydrogen • Nitrogen
and other high pressure gases

The BASTIAN-BLESSING Company

4201 W. Peterson Avenue Chicago 30, Illinois

Pioneer and Leader in the Design and Manufacture of Precision Equipment For Using and Controlling High Pressure Gases

Callinite*



improves welding efficiency in your plant...

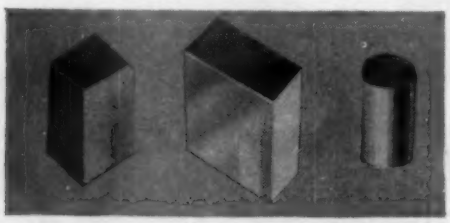
*Callite's Tungsten Alloy for Electrode and Heavy-duty Contact Facings

RESISTS HEAT • HOLDS ALIGNMENT • RETAINS SHAPE

If you've a welding problem that could be solved by improved weld-quality, reduction of rejections due to poor tip dressing — Callinite is your solution.

Developed by Callite engineers as a facing for all contacts calling for high current-carrying capacity and thermal efficiency, Callinite is available in two basic types. Type TC — essentially for heavy-duty applications — withstands severe electrical erosion and mechanical wear. Type ST — for higher conductivity — is used where heavier current is encountered. Each type is available in several grades to meet exactly the specific requirements of the metals worked.

Callite engineers — experienced in the metallurgical field — are at your disposal. For a complete description of Callinite write for Bulletin No. 158. Callite Tungsten Corporation, 549 Thirty-ninth Street, Union City, New Jersey Branch offices in Cleveland and Chicago.



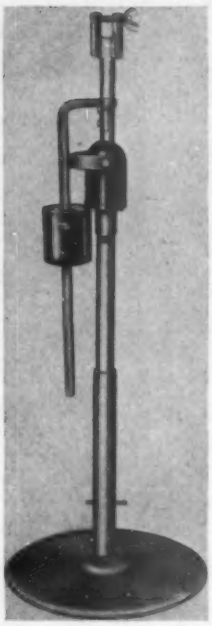
Standard and special shapes in tungsten, molybdenum, silver, platinum, palladium and various alloys of these metals.

OVER 27 YEARS OF PIONEERING IN TUNGSTEN METALLURGY

Callite FACING MATERIALS

CALLITE TUNGSTEN CORPORATION CT

Callinite is ideal for facing contacts of all types where high conductivity is required and where pitting, sticking and welding are normally encountered.



"M-1 Powrarm" positioner permits operator to work with both hands free

Welding Positioner

THE "Powrarm" M-1, a universal positioner for welding, holds light work and turns it 360 deg on vertical planes. A twist of the wrist turns the work to the desired position; this quick and easy operation is made possible by a new mechanical principle of pressure applied to a ball-and-socket joint. Attachments to use with this positioner allow many different types of work to be mounted for welding, such as carburetors, distributors, speedometers, generators, magnetos, chassis, airplane cylinder heads, castings, machined parts, compressors, transmissions, sewing machines, etc. GARFIELD ENGINEERING CORP., Kansas City, Mo.

* *

Squaring Shears

WELDED steel squaring shears built from heavy plate are offered for all types of shearing and trimming jobs on sheets up to 14 gauge. The plate components are welded in a box-type design and normalized to relieve stresses. Standing 47 in. high, the unit has a cutting length of 73 in., back gauge range of 18 in., front range of 38 in. Up to 85 strokes per minute can be obtained from the motor-driven tool-steel blades. PARKER MFG. CO., 2200 Colorado Ave., Santa Monica, Calif.

* *

Air-Line Regulator

DOCKSON offers a new pressure regulator (No. 45) that can be used on lines handling either air or carbon dioxide. It can be used in any operation where it is necessary to reduce cylinder pressure to a range of 1—75 lb. A ¼-in. side inlet permits the regulator to be equipped with a pressure gauge, and a ¼-in. rear inlet is available on special order. DOCKSON CORP., 3839 Wabash, Detroit 8.

News of the Industry

Name Winners in $37,500 Agricultural Program

WINNERS of cash awards totaling $30,000 and scholarships valued at $7,500 in The James F. Lincoln Arc Welding Foundation's Agricultural Award and Scholarship Program were recently announced by Dr. E. E. Reese, chairman of the Foundation's board of trustees and head of the department of electrical engineering of Ohio State University.

The winners and the amount of each of the first six awards in the program's two divisions were: (Division I, Agricultural Producers): Elgar Schroeder, Morrisonville, Wis., first award, $3,284.70; Alfred F. Foote, R.F.D. 3, Brooklyn Station, Cleveland, second award, $3,189.80; Ray Doyen, Rice, Kan., third award, $1,094.90; Mr. and Mrs. Albert Graeff, Osborn, Mo., fourth award, $821.17; Glennon F. Argenbright, Blandinsville, Ill., fifth award, $547.45; and Daryl Stengel, Milban, S.D., sixth award, $273.72.

Division II (Agricultural Education and Services): Harold E. Gulvin, agriculture teacher, Forestville Central School, Forestville, N.Y., first award, $3,964.75; Ray T. Nicholas, Grayslake, Ill., county agricultural agent, Lake County, Ill., second award, $2,643.15; M. C. Buchanan, Salem, Ore., agriculture teacher, Eugene High School, Eugene, Ore., third award, $1,321.55; Clarence D. Jensen, Visalia, Calif., agricultural mechanics instructor, Visalia Union School, fourth award, $991.20; Laura Lane, editor, Extension Service, Texas Agricultural and Mechanical College, College Station, Tex., fifth award, $660.75; Ralph W. Canada, associate professor of agricultural education and G. A. Schmidt, emeritus professor of agricultural education, Colorado State College of Agriculture and Mechanic Arts, Fort Collins, Colo., sixth award, $330.40.

A total of $7,500 is awarded to the colleges of agriculture in the states in which the top five winners in both classes reside.

* *

Sweden Plans 396-Mile All-Welded Pipe Lines

AN elaborate project for an oil pipe line right across Sweden from Gothenburg to Stockholm was recently put forward by the Gothenburg Port Authorities and is now being examined by a specially appointed Government committee, headed by Professor Karin Kock. According to this plan, two all-welded steel tube lines, one 8 in. in diameter for heavy oil and one 4 in. diameter for gasoline, should be built. This double pipe line, intended for the transportation of 2 million tons of oil annually to the industrial districts in Central Sweden, is calculated to cost $5,000,000 to construct. Total length will be 396 miles, including two branch-lines to the towns of Vasteras and Nynashamn.

Courtesy, U.S. Steel Corp.

Corrugated sheet steel for the building industries, roofing, etc. awaits shipment at Carnegie-Illinois Steel Corporation's Gary sheet mill. Lots of new work for welding!

THIS REVOLUTIONARY NEW WELDING DEVELOPED WITH WAR DEMANDS FOR SPEED

IMMEDIATE DELIVERIES

make it possible for you to have now the many advantages of

All-State

LOW-TEMPERATURE WELDING

It takes so little TIME
It takes so little HEAT
It takes so little ROD
It takes NO *special equipment*
And it's EASY *to do.*

EXAMPLE: Suppose you have to repair a broken link in a chain hoist. You can do the job and have the chain back in service in two minutes with All-State No. 11 rod. There are 1001 other jobs that you can do better and quicker with low temperature. The quick, easy way to get started is to send for All-State's new catalog B2, just out, which tells about the savings available and how to use low-temperature welding. Write to the address below for complete information, and let us know if you'd like a demonstration in your own plant.

ALL-STATE WELDING ALLOYS CO., Inc.
98 WEST POST ROAD • WHITE PLAINS, N. Y.

GREYHOUND FARM WELDERS

Can be used on any Farm that has suitable Power lines. The Greyhound Farm Welder conforms to NEMA standards and EEI and REA requirements.

Built-in Power Factor Correction, ideal for Rural Power Lines.

SAFE—frame and housing of welded steel—electrically grounded metal case.

Continuous current control, quick adjustment by simply turning a Hand Wheel providing infinite number of current settings.

Portable—easily moved about.

Economical to operate.

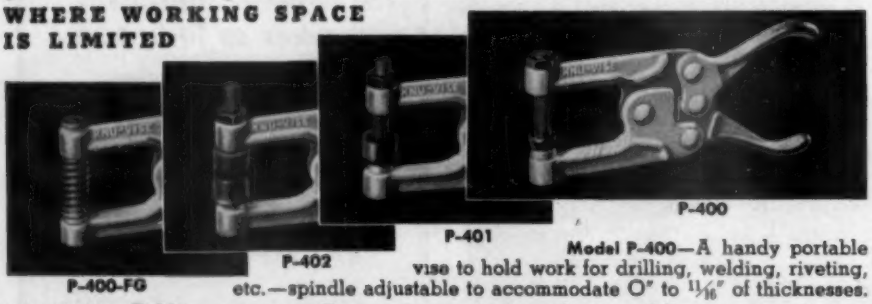
Greyhound Welders sold exclusively thru Distributors in the U.S. and foreign countries.

GREYHOUND A. C. ARC WELDER CORP.

604-606 Johnson Ave., Brooklyn 6, N. Y.

THE PLIERS

FOR QUICK CLAMPING AND RELEASING WHERE WORKING SPACE IS LIMITED



P-400-FG P-402 P-401 P-400

Model P-400—A handy portable vise to hold work for drilling, welding, riveting, etc.—spindle adjustable to accommodate 0" to 1 1/16" of thicknesses.

Model P-401—Rubber cap on spindle serves as protection when two different materials must be held together. Curved handles make for comfortable operation.

Model P-402—Has two rubber caps—especially desirable where both surfaces of material held require protection, such as fine woods, etc.

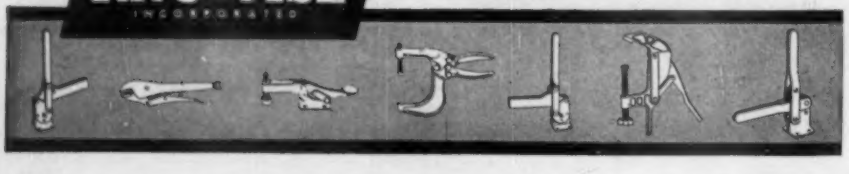
Model P-400-FG—Requires no presetting—spindle automatically adjusts itself to varying thicknesses of materials held—from 0" to 3/8".

Toggle Action enables operator to apply and release pliers with simple, effortless motion. Screw driver slot in spindle is used to preset required pressure. Normal hand pressure attains 400 pounds. Pliers are made of forged steel, cadmium plated—also available in larger sizes.

KNU-VISE INCORPORATED

2207 Eighth St. Detroit 16, Michigan

4328 San Fernando Rd. Glendale, Calif.



Optimus Companies Open New Enlarged Plant

BUILDINGS of the former Matawan Tile Co., were recently purchased by the Hanson-Van Winkle-Munning Co. to provide its subsidiaries, Optimus Equipment Co. and Optimus Detergents Co., both of Matawan, N.J., with increased space and manufacturing facilities. All office, sales, laboratory, design and manufacturing personnel are located at the new plant, which is under the direction of Allen T. Baldwin, general manager.

* *

Tool Co. Expands Aurora, Ill., Works

INDEPENDENT PNEUMATIC TOOL CO., Chicago, has begun expansion of its main works at Aurora, Ill. Site for the $1,000,000 addition has been cleared adjacent to the company's main plant. Construction of the annex, which will provide 85,000 sq ft of additional floor space, will begin shortly.

* *

Alabama Welding Shop Becomes Two Businesses

JOE B. MOORE and JERRY E. CARROLL, owners of the former Morris & Moore Welding Shop, 27th & Jackson Highway, Sheffield, Ala., have set up two separate businesses under the names of Tennessee Valley Machine & Welding Co. and Tennessee Valley Supply and Equipment Co. These businesses will be operated at the same address with no changes in personnel or management.

* *

Welding Co. Changes Name and Location

INDUSTRIAL Welding and Repair Co., Inc., 1536-38 Chicago Road, Chicago, has changed its name to Industrial Welding Co., Inc. The firm has also moved to a new address at 66 E. 23rd St., Chicago Heights, Ill.

* *

Steel Treating Co. Opens New York Branch Plant

LINDBERG STEEL TREATING CO., Chicago, has opened a branch plant located at 620 Buffalo Road, Rochester, N.Y. The new plant has facilities for complete heat-treating services.

Correction

Two errors occurred in the Airco listing of Data Sheet No. 75, "Trade Names of Electrodes and Comparative AWS-ASTM Designations," which should be corrected to make this sheet accurate. Under the designation E-4511 both references should be removed as 63 is an E-4510 electrode and 44 is no longer made. Under E-6020, the figure 365 should be changed to read 315. We regret these errors and hope you will correct your data sheet accordingly.

New Heat-Treating Process for Flash Welding Wire

An automatic heat-treating process which facilitates the flash welding of hard-drawn, high-carbon steel wire is described in a recent research report prepared by R. W. Bennett and R. D. Williams, engineers of the Battelle Memorial Institute, Columbus, O., under contract with the Navy Bureau of Ordnance.

Strong, low-cost butt welds were made at a production rate of more than one per minute. Early experimental welds were extremely hard and brittle because of rapid cooling. The problem was solved by developing an automatic heat treatment which transformed the austenite in the weld zone directly into a soft, relatively ductile structure consisting largely of pearlite. The heat treating was accomplished in the welding dies immediately after upset by arresting the temperature of the joint at 1,000 F during cooling and maintaining that temperature until the desired transformation had been completed.

Orders for this report (The Flash Welding of Hard-Drawn High-Carbon Steel Wire; PB-36207; photostat, $3; microfilm, $1) should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D.C., accompanied by check or money order payable to the Treasurer of the United States.

Five other reports concerning various phases of welding are also offered by the Office of Technical Services. The titles, dates and prices of these reports are listed below:

PB-34074: Welding of High Strength Structural Steel; photostat, $1; microfilm, $1; Sept., 1945. PB-34072: Welding of Hardenable Steels with High Alloy (Austenitic) Electrodes; photostat, $5; microfilm, $2; March, 1946. PB-39591: Practical Importance of Hydrogen in Metal-Arc Welding of Steel; photostat, $3; microfilm, $1; April, 1946. PB-20179: Stress Relief of Weldments for Machining Stability, Part I; photostat, $5; microfilm, $1; Dec., 1943. PB-40547: Stress Relief of Weldments for Machining Stability, Part II (Final Report); photostat, $2, microfilm, $1; July, 1944.

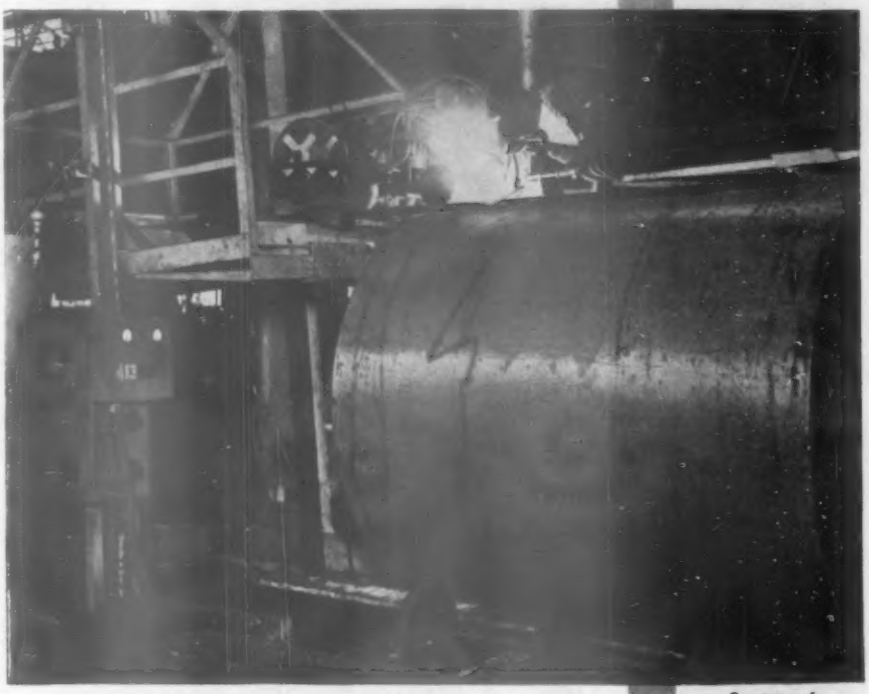
* *

Bastian-Blessing Wins Second Safety Award

For the second time in one year the Bastian-Blessing Co., Chicago, has received from the United States Department of Labor, the award of a Certificate of Safety Achievement. These two awards make the company one of the most notable plants in the country from a safety standpoint.

The Certificates are awarded on the basis of frequency rate (number of lost-time accidents per million man hours worked). Figures taken from the Bureau of Labor Statistics show that this company's frequency rate for the past year stands at 1.9, compared with the national average of 23.0 for all non-ferrous metal manufacturers.

HOLD-ARK ELECTRODES help get greater TENSILE STRENGTH in welds



Courtesy of Lincoln Electric Co.

Welds with tensile strength up to 70,000 pounds per square inch—15,000 to 25,000 pounds better than average structural steel—is the claim of a leading maker of automatic carbon-arc welding machines. To do jobs like this, welding-machine makers and users choose Speer Hold-Ark Electrodes.

Strength like this is proof that—when strong welds are essential—the *right electrodes* are carbon electrodes. And when economy is important, too, the *right carbon electrodes* are Speer Hold-Ark.

See if the arc of Hold-Ark Electrodes doesn't give you stronger, neater welds. And notice how much longer Hold-Ark Electrodes last—you can use them down to the last inch. For hand or automatic welding, the better electrode is Hold-Ark. Order a trial lot today.

SPEER
CARBON COMPANY
ST. MARYS, PA.

2309
CHICAGO • CLEVELAND • DETROIT
MILWAUKEE • NEW YORK • PITTSBURGH

DOCKSON #145 KIT

A COMPLETE WELDING AND CUTTING OUTFIT

This 145 easily handles any light or medium welding or cutting operation up to 3-inch steel plate.

• Finest design and construction • Scientifically balanced, sturdy equipment for effortless operation • Economically priced. Today's best buy in a quality outfit.

FACE SHIELDS • GOGGLES • HELMETS FOR EVERY NEED

Write for your copy of our Welding or Safety Equipment catalog.

Dockson CORPORATION
3839 WABASH AVE. • DETROIT 8, MICH.

CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator (*as NOT necessary to release control screw before opening tank valve*).

PRICE IS LESS THAN ONE REPAIR BILL ($6.00 EA.)

#1. STANDARD COUPLER . . . for all standard size welding type oxygen regulators.
#2. LIGHT COUPLER . . . for "airplane" or soldering size oxygen regulators.
#3. HEAVY DUTY COUPLER . . . recommended for extra heavy duty work only.
#4. SCREW TYPE COUPLER . . . for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
#5. FOR HYDROGEN . . . left hand thread coupler.

We also Make MEDICAL CHEK-SHOCKS for All Types of Medical Regulators and Tank Fittings (chrome plated) . . . $8.00 Ea.

SEE YOUR DISTRIBUTOR OR WRITE—

Chek-Shock MFG. CO.
FOWLER, CALIF.

"Plymetal" Combines Wood with Metal

CIGARETTE-proof desk tops, fireproof office partitions, lighter airplanes are made possible by a new method of combining metal and plywood layers in manufacture, according to Thomas D. Perry, development engineer of the Resinous Products and Chemical Co., Philadelphia. In a paper presented during the wood industries session of the recent annual meeting of The American Society of Mechanical Engineers, he described "plymetal" as a relatively new product which combines the good qualities of both wood and metal and compensates for the less desirable qualities of each. It is made, he said, by gluing layers of metal to sheets of veneer with a resin adhesive, while heat and pressure are applied simultaneously.

* *

LETTER TO THE EDITOR

"ANYONE following the standards and discussion covering arc-welding electrodes and techniques cannot help but wonder. Here is a process that has been used in billions of cases for every imaginable purpose over a generation, whose record has been almost perfect, yet it is criticized and limited more than any comparable process in all mechanical history. The criticism is not because of failure, as there is none. The criticism is entirely in the region of theory covering conditions which could never occur in commercial application.

"In the case of mild steel, which embraces more than 95% of all the welding which is done, the welded joint is very much stronger and has a very much higher elastic limit than the plates joined. Yet, because of this program of criticism, great and unnecessary expense is put upon the manufacturer using welding. This, of course, is paid by the buyer in higher prices. No reason nor any possible return accrues to the user.

"There are countless illustrative cases that could be cited; the following are examples. If there is surface porosity, even so much as one little hole on the surface, the weld is rejected. If that same little hole is below the weld surface where it can not be seen, the manufacturer must ferret it out with expensive X-ray, then cut out and reweld the joint at great expense. The question is naturally asked 'Why?'

"I am enclosing three photographs [not reproduced] which show: (1) a welded joint with abundant surface porosity, (2) a welded joint with an abnormally large amount of internal porosity and (3) a weld with an abnormal amount of undercut. Tensile specimen No. 1 failed *in the plate* at 59,100 psi; No. 2 failed in the plate at 62,500 psi, and No. 3 also failed in the plate at 59,400 psi.

"Here is the proof of all the above statements regarding the efficiency of welded seams with so-called defects. Here is porosity carried to the greatest extreme that skill can take it, yet the

joint is stronger than the plate. Here is great undercut and even laps in the weld that still break the plate in tension. Not only would such joints be rejected, but if they had 1% of these so-called defects, the structure itself would be rejected.

"It is perfectly obvious that there could not possibly be a riveted joint which could join any of these pieces of steel together in any way which in tension would not break, yet there is no testing of the rivets, no X-ray of the voids in their joints, no elimination of the undercut; yet we know that all of these defects are present in every riveted joint, not only occasionally but in every case. Again we ask the obvious question: 'Why accept such defects in a riveted joint and reject them in arc welding with its greater strength, ductility and soundness?'

"Engineering has contributed to America's prosperity in an unbelievable way, but I tremble to think what would occur to our prosperity if all engineering were as remiss in its understanding of the problem as is true of many engineers' attitude toward electric welding.

"There is no doubt that if the foolish restrictions, which can add nothing whatsoever to the success of any welded joint, were removed the cost of welding many structures could be reduced by as much as 90% in some cases, yet because of these restrictions, concurred in by many engineers, the industry paid hundreds of millions of dollars in additional costs over the years with no increase in safety and no betterment of the product from any point of view.

"These same restrictions still stand and are rapidly being amplified . . . Such a program must be stopped."

J. F. LINCOLN (signed)
President, The Lincoln Electric Co.

New Distributors

All-State Welding Alloys Co., Inc., White Plains, N.Y.: Bakers Welding Supply Co., Bakersfield, Calif.; Butler Cylinder Gas Co., Reading, Pa.; Cottet's Welding Supply Co., Syracuse, N.Y.; Cook Iron Store Co., Rochester, N.Y.; Eugene Welders Supply Co., Eugene, Ore.; Welders Supply Co., Scranton, Pa.; G. L. Merriam Co., Greenfield, Mass.; Sears and Bowers, Easton, Pa.; Joe Beckett, Allentown, Pa.; Welders Supply Co., San Diego, Calif.

* *

American Agile Corp., Cleveland: Monroe Sales Corp., Philadelphia 2 (distributor of welding electrodes and accessories).

* *

Ransome Machinery Corp., Dunellen, N.J.: Welding Equipment & Supply Co., Detroit 7 (distributor of welding positioners and turning roll equipment).

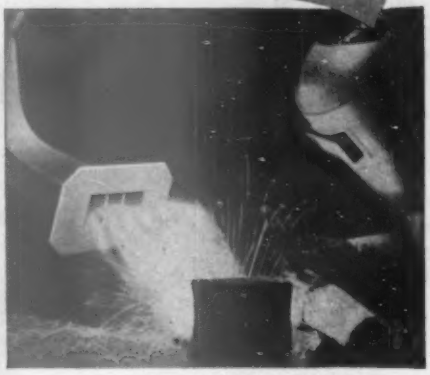
* *

Wall-Colmonoy Corp., Detroit: Welding Equipment & Supply Co., Detroit 7 (distributor of hard-facing rods and "Spraywelders").

Why the RUEMELIN FUME COLLECTOR is a REAL NECESSITY

● THE OLD WAY

● THE NEW WAY



SOME PROMINENT USERS —
SANTA FE RAILWAY SYSTEM
PENNSYLVANIA RAILROAD
INTERNATIONAL NICKEL COMPANY
JONES-LAUGHLIN STEEL COMPANY
NEW JERSEY ZINC COMPANY
MORGAN-SMITH COMPANY
ANCHOR HOCKING GLASS CO.
SINCLAIR REFINING COMPANY
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NATIONAL LEAD COMPANY
MASSEY HARRIS COMPANY
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MAYNARD ELECTRIC STEEL CASTING CO.

PATENTED

TWO MODELS!

- Long reach Model D-5342 — ideal for large welding booths; reaches out 15 feet from wall.
- Standard Model D-5310—used for standard welding booth ventilation; hood reaches out 9 feet from wall.

The Ruemelin Welding Fume Collector has been specially engineered to eliminate noxious fumes. The inlet hood maintains a constant high velocity over the working area, quickly removing heat and smoke *at the source.* Welders equipped with this device are assured of a clean shop atmosphere; the manufacturer gains by increased daily production.

The fume collector hood can be instantly placed where needed anywhere in the booth welding area. No tedious adjustment necessary. Just pull the inlet hood to the welding position and you are ready to go. Approved by state industrial commissions and by compensation insurance companies. Many users send in repeat orders. Write for bulletin 37-C today.

RUEMELIN MANUFACTURING CO.
3880 N. PALMER ST. • MILWAUKEE 12, WISCONSIN
Manufacturers and Engineers of Sand Blast and Dust Collecting Equipment

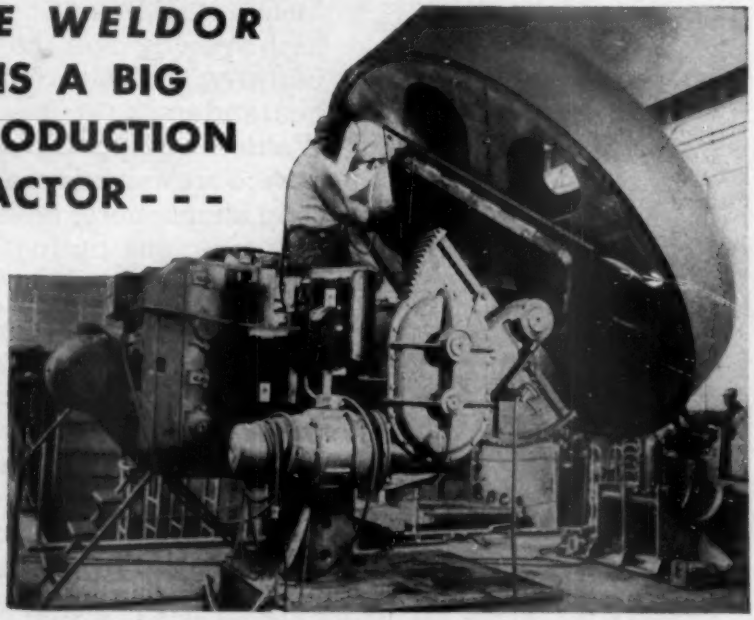
WATCH FOR

Announcement

The 12th Edition of

WELDING ENCYCLOPEDIA IN MARCH

THE WELDOR IS A BIG PRODUCTION FACTOR - - -



Your welders are big production factors when they work with C-F Welding Positioners because these power operated Positioners with variable speed table rotation are real production tools. Better automatic welding is possible because the C-F Variable Speed feature governs table rotation speed from 0 r.p.m. and up—assuring better control of fillet in circular or peripheral automatic welding.

If increased production, better downhand welding and lower costs in your welding department can help you meet the competition for new markets, C-F hand and/or power operated welding positioners should be your first choice. Write for Bulletin WP 22.

CULLEN-FRIESTEDT CO.

1309 S. KILBOURN AVENUE CHICAGO 23, ILL.

McGraw-Hill Pacific Coast News Bureau

Robert H. Porter, G-E field engineer, right, receives the Charles A. Coffin Award from Allan G. Jones, Pacific district manager, apparatus department

Porter Wins Coffin Award for Work in Welding

ROBERT H. PORTER, General Electric field engineer, was recently awarded the Charles A. Coffin Award for outstanding engineering ability and sales performance in the welding field. The Coffin Award is the company's highest employee recognition.

Mr. Porter, a native West Virginian, has been with G-E in San Francisco for 20 years.

* *

Lincoln Co. Directs New Arc-Welding Color Film

UNDER the supervision of the Lincoln Electric Co., Cleveland, a technicolor movie, "The Magic Wand," has been produced by Science Films, Inc. This ten-minute film depicts how arc welding has produced lighter steamships, locomotives, automobiles, aircraft and home applicances. The picture is being offered free to theatres via Modern Talking Picture Service. Lincoln Electric has also contracted for 3,000 protected theatrical showings and for additional club and school showings of a longer, 23-minute version.

* *

Inco Sponsors Metals Course for Employees

ABOUT 160 employees of the International Nickel Co., Inc., have enrolled voluntarily at Stevens Institute of Technology, Hoboken, N. J., to take a special course in the fabrication and use of metals. Organized by W. T. Hesse, president of the Inco club and E. R. Patton, chairman of special activities, the course is the first of its kind for the company. Students include men and women from the development and research, sales and publicity departments, technical library and other departments of the corporation. Classes are for two-hour periods, once a week.

Detroit AWS Holds Quiz of Experts

ONE of the most ambitious meetings yet undertaken by the Detroit section of the American Welding Society will take place Feb. 14, when several hundred members are expected for what is billed as the "first international quiz of the experts."

Picked teams of welding technicians representing the Canadian Welding Society, Detroit, Cleveland and the Mahoning Valley sections will compete in answering questions posed by the audience. The day's events will include presentation of the Samuel Wylie Miller Memorial Medal to James F. Lincoln, president, Lincoln Electric Co. Inc., Cleveland, for "conspicuous contributions to the advancement of the welding or cutting of metals."

The national board of directors will meet during the day, prior to the evening quiz session, at the Rackham Memorial building. Presiding at this meeting and at the evening session will be L. W. Delhi, national president of the AWS. The president of the Canadian Welding Society, Mr. Fullerton, will also be in attendance.

* *

To Install Nazi Equipment at Stevens Institute, N.J.

GERMAN equipment for the manufacture of hard-cemented carbides will soon serve to advance American research. The equipment has been brought from Germany and will be installed in a newly constructed building at Stevens Institute of Technology, Hoboken, N.J. It will form the basis of a Navy-sponsored research program on high-temperature alloys, so important to the future development of jet-propelled airplanes and rockets.

* *

Omaha Welding Co. to Hold Conference March 4, 5, 6, 7

ARRANGEMENTS are now in process for the annual welding "confab" to be staged March 4, 5, 6 and 7 by the Omaha Welding Co., 1501 Jackson St., Omaha, Neb. Between 1,500 and 2,000 guests are expected to be in attendance at what is anticipated to be the largest conference and exhibition the company has ever sponsored. Company officials are in hopes that their new building will be completed in time to celebrate its grand opening on this occasion.

* *

Progressive Forms New Department

IN an effort to provide process engineering service wherever resistance welding is considered as a means of fabrication, Progressive Welder Co., Detroit, has created its own process engineering department. Services of the department, which include all phases of resistance welding, are available to industry individually or as a complete service.

First Choice for

LOW TEMPERATURE BRAZING

APW **NO. 217**

SILVER BRAZING ALLOY

For clean, sound leakproof joints of

STEEL
STAINLESS STEEL
ALLOY STEEL
COPPER
BRASS · BRONZE
INCONEL
MONEL METAL

No. 217 has proven its value in industry as an economical and efficient all-purpose Silver Brazing Alloy. It melts at 1145°F and has excellent flow and penetrating properties.

●

All APW Silver Brazing Alloys are available in strip, coiled wire, wire rings, flat washers and special shapes to meet your specifications.

APW No. 369 PASTE FLUX

A fine flux for production brazing with APW low temperature brazing alloys.

Gives maximum protection to surfaces of metals being joined and actively promotes flow of molten alloy. Easily soluble in hot water.

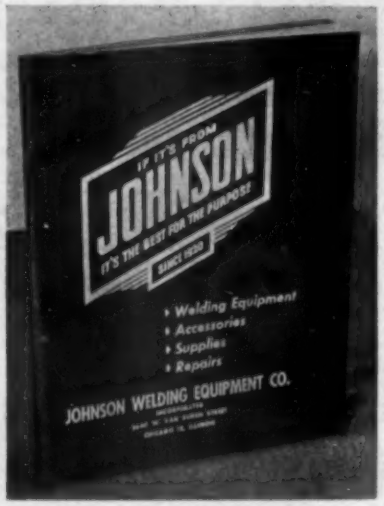
We invite your inquiries.

THE AMERICAN PLATINUM WORKS

231 NEW JERSEY R.R. AVE., NEWARK 5, N. J.

PRECIOUS METALS SINCE 1875

Photologue -------FOR WELDING CATALOG SERVICE



The Johnson Welding Equipment Co.'s New catalog of Chicago, Illinois.

Specializing in catalogs for Welding Equipment Distributors

Catalogs provide an economical means of soliciting business from many of the smaller users of Welding Equipment.

Photologue Publishing Co.
CATALOG PUBLISHERS
610 W. VAN BUREN ST. - - - - - - - CHICAGO, ILLINOIS

Announcing

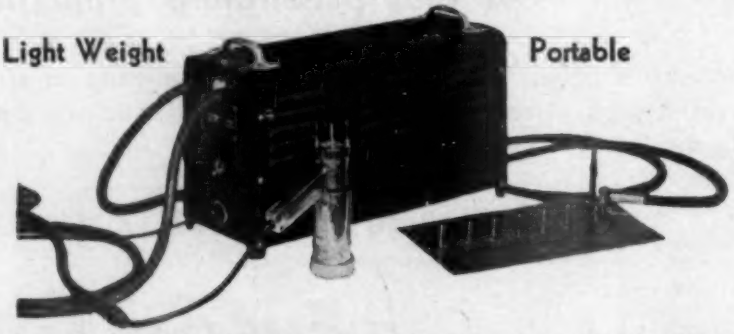
THE GRAHAM STUD WELDING GUN

especially designed for

STUD WELDING ALUMINUM

from 1/16" to 3/4" diameter

Light Weight Portable



Makes uniform welds simply and instantaneously without the use of timing devices or contactors. Operation is economical and foolproof. The operator needs no skill or training. Welds are clean, smooth and made without distortion or heating of metal. There are practically no craters or fillets and no flux is necessary.

No Generator is required

Mfd. by Boston Cutting Die Co., Boston, Mass.

For further information write to

C. H. STEVENS & COMPANY

15 ANN ST. *Sales Agents* SOUTH NORWALK, CONN.

Opportunity for Welding in Steel-Mill Maintenance

Cost of keeping steel plants and their equipment in good running order during 1945 rose to a record figure of slightly more than $542,000,000, according to a report of the American Iron and Steel Institute. This increase of $3,000,000 over 1944 marked the seventh successive year in which housekeeping costs in the industry have risen over the previous year. Due to the difficulty of obtaining replacements for some equipment that has passed its peak efficiency, it is believed that repair and maintenance costs during 1946 will also be high when the final figures have been compiled. Some of the money that was to have been spent in 1946 for an anticipated $327,000,000 expansion program for the industry had to be diverted to repairs and maintenance because of material shortages. There is no doubt that through the use of welding and its many applications these costs can be greatly reduced.

* *

Production Show in Chicago, March 17–19

An attendance of 20,000 production executives, technologists, sales managers and purchasing agents is expected at the Chicago Production Show and Conference to be held March 17, 18 and 19 in the Exhibition Hall of the Stevens Hotel. This event will be sponsored by the Chicago Technical Societies Council, an affiliation of 48 local groups. Further details about the show and conference may be obtained from the Chicago Technical Societies Council, 53 W. Jackson Blvd., Chicago 4.

* *

CPA Authorizes $6,549,852 for Industrial Construction

Civilian Production Authorities' facilities review committee recently authorized 140 non-housing construction projects to cost a total of $6,549,852 and denied 256 applications costing $15,808,837.

Largest project approved was for construction of a power plant by Bethlehem Steel Co., Sparrows Point, Md., at an estimated total cost including equipment of $9,168,245. Among the other projects was a $12,000 welding shop for the Rich Street Welding Co., Columbus, O.

* *

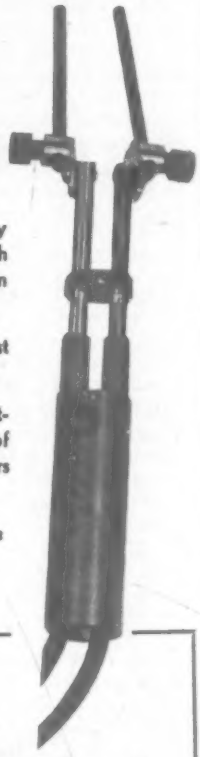
To Weld Three-Mile Radiant Heating System

More than three miles of welded wrought-iron pipe will be used in fabricating the grid coils for the radiant heating system of a basementless, one-story building under construction in South San Francisco for the Rough Rider Mfg. Co. The structure has a floor area of 41,000 sq ft and will be built at a reported cost of $350,000.

The coils, laid on a gravel fill, are embedded in the 4-in. concrete floor and gas welded on the job site.

A BETTER ELECTRIC ARC TORCH

Check These Features



1. Easy to operate—only 10½ inches in length and one pound in weight
2. Long lasting—highest grade materials used
3. Quick changing—fittings handle all sizes of carbon—no adapters needed
4. All parts replaceable

★

NEW TWIN THERMATORCH Jr.

The answer to your alloy welding problems . . . aluminum, brass, and copper. No porosity and slag occlusions that are encountered with other methods. Excellent for general heating and straightening because of the extremely hot arc.

Complete with cable for only **$12.95.**

Ideal for every shop and farm use.

Write Today.

PLYMOUTH EQUIPMENT & SUPPLY CO.

P. O. Box 358

PLYMOUTH, MICHIGAN

Distributors: A few territories still open.

About People

Dr. Vannevar Bush, president of the Carnegie Institution of Washington and wartime director of the Office of Scientific Research and Development, has been named 1946 winner of the Hoover Medal. This honor is jointly awarded "for distinguished public service," by the American Institute of Electrical Engineers, American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers and The American Society of Mechanical Engineers.

* *

V. J. Rauer, G. M. Patton and R. G. Mussen have been appointed to supervisory manufacturing positions in the metallurgy division of the General Electric chemical department. Mr. Rauer was named supervisor of production, Mr. Patton, supervisor of planning and wage rate and Mr. Mussen, supervisor of test and inspection. Other appointments include J. C. Morrison as assistant general foreman, and R. L. Beilhart, P. J. Moola, J. F. Pickert, J. H. Yeomans and E. A. Rees as foremen.

* *

Harry Julius of the St. Louis branch of the Liquid Carbonic Corp. was recently awarded a 50-year pin representing the length of time he has served with the company. Awards were also presented to Tully DeStefani, Chicago, Henry Guttman, Dallas, Guilbert Winchell, Boston, N. F. Bader and H. N. Thomas, New York, for having been with the company 45 years or more.

* *

Morris Evans Leeds has been awarded the ASME medal for his achievements in the invention and development of electrical and temperature measuring instruments and in the field of industrial relations. Mr. Leeds is the inventor of the "Leeds mechanism," a basic element in the automatically-operated balanced-current recording and controlling instruments that have become indispensable in modern industry.

* *

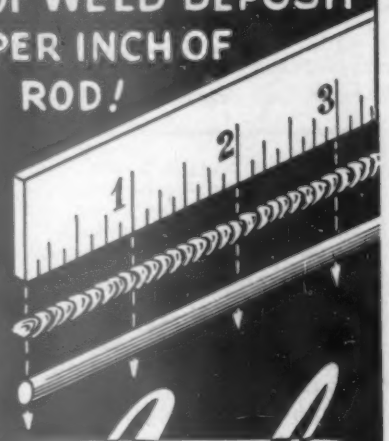
Paul R. Pollock has been named Manager of the Denver, Colorado, office of the Allis-Chalmers Mfg. Co. Mr. Pollock is a member of the AIEE, ASM and the Society of Naval Architects and Marine Engineers.

* *

Frank B. Lounsberry has been named to succeed Vere B. Browne, who retires as vice-president and technical director of the Allegheny Ludlum Steel Corp. Mr. Browne becomes an honorary vice-president and will be available as a consultant.

1 INCH

OF WELD DEPOSIT PER INCH OF ROD!



Agile

"GREY" WELDING ELECTRODES

For sheet metal welding this electrode is outstanding. It is designed for the welding of thin gage sheet metal in the horizontal and downhand welding positions. It is a "cold rod" — no warping — NO "BURN THROUGH."

"BLUE-GREY" WELDING ELECTRODES

This electrode is semi-automatic and is the *easiest handling rod available.* It practically welds by itself and is recommended for mild steel horizontal welding. It is speedy and economical. The slag actually REMOVES ITSELF!

AGILE ACTARC

AMERICAN AGILE CORPORATION

5806 HOUGH AVENUE

CLEVELAND 3, OHIO

Send for your catalog

Weldit Automatics

WELDING TORCH W-45. Strong and sturdy, 14 inches long, yet light in weight—only 17 ounces. Has lock control for continuous welding. Cuts oxygen and acetylene cost ⅓.

BLOWPIPE C-46. Has good balance . . . Comfortable grip . . . Closed hand releases gas . . . Open hand cuts it off . . . Reduces idle flame fire hazard . . . Works perfectly with natural gas, manufactured gas, butane and compressed air.

WELDING TORCH W-46. Has long lever for closed hand or finger-tip gas release or cut off. Allows wider operation range. Weight 14 ounces, length 13 inches.

Meet all Underwriters Requirements

WELDIT automatics are daily cutting costs, reducing fire hazards in many of the world's largest industrial plants. Some distributor territory still available. Write today for free descriptive bulletin.

Weldit INC. SINCE 1918

994 OAKMAN BLVD. • DETROIT 6, MICH.

Your WELDING JOBS Are Done

FASTER EASIER BETTER

when you use...

Mid-States METAL ZIPPER

Do your welding jobs faster, easier, better and make more money . . . with Mid-States Metal ZIPPER, world's finest arc welder! Packed with exclusive features! Extremely easy to operate! Outperforms anything in the welding field, yet costs no more. Get the most for your welder dollar . . . get a Metal ZIPPER!

See your jobber or write for complete details, now!

Mid-States EQUIPMENT CORP.

2429 SOUTH MICHIGAN AVENUE, CHICAGO 16, ILLINOIS

DR. ROBERT HOLLENBECK ABORN has been appointed assistant director of the research laboratory, U.S. Steel Corp., Kearny, N.J. Dr. Aborn is prominent in welding research, having won the Lincoln Medal of the American Welding Society in 1941. During the war he served for a year on the War Metallurgy Committee of the Office of Scientific Research and Development.

* *

G. REED SCHREINER, formerly advertising manager of Carnegie-Illinois Steel Corp., has been appointed assistant advertising director for U.S. Steel Corp. He succeeds REESE H. PRICE, resigned. ROBERT J. WILCOX has replaced Mr. Schreiner as acting advertising manager. HARRY E. LORENZ has been appointed purchasing agent for Carnegie-Illinois and will be assisted by C. H. BARINGER and F. G. BUCHHEIT.

* *

CHARLES B. GRACE, vice-president and treasurer of the Heintz Mfg. Co., Philadelphia, has been elected a member of the board of directors of the Pennsylvania Salt Mfg. Co. BARTON I. HOGARTH, formerly associated with the Carbide and Carbon Chemical Co., has been named to the newly-created position of purchase engineer in the equipment and supplies division of the salt company.

* *

The Allegheny Ludlum Steel Corporation award for distinguished service among executives and employees has been presented to VERE B. BROWNE, vice-president in charge of research; WALTER M. PATTERSON, manager of the electric furnace department, Brackenridge, Pa.; DAVID P. BARTELL, chief chemist at Brackenridge and WALTER MISCOSKY, Brackenridge chemical laboratory.

* *

L. R. MILBURN, electrical engineer, Great Lakes Steel Corp., Ecorse, Mich., has been elected president of the Association of Iron and Steel Engineers for 1947. He will thus help the AISE celebrate its 40th year of service to the nation's iron and steel industry.

* *

THOMAS A. FARRELL, formerly assistant general sales manager for the Kelvinator division of Nash-Kelvinator Corp., has been named vice-president of the newly-formed Dearborn Motors Corp., Dearborn, Mich.

* *

ROBERT F. BOGER has been appointed publisher of AVIATION, AVIATION NEWS and AIR TRANSPORT. These three technical magazines are publications of the McGraw-Hill Publishing Co., Inc.

* *

GEORGE P. HOUGH has been appointed executive administrator of the A. O. Smith Corporation's Chicago district office. He succeeds DON T. ALLEN, resigned.

HARRY A. DENNIS has been appointed assistant district sales manager for Lukens Steel Co., By-Products Steel Corp. and Lukenweld, Inc. His headquarters are at 332 S. Michigan Ave., Chicago 4.

* *

ERNEST E. GEORGE and ABNER B. WELLBORN have been appointed engineer and superintendent, respectively, of the metallurgy division of the General Electric chemical department.

* *

THOMAS E. BERRY has been appointed eastern seaboard sales manager for All-State Welding Alloys Co., with headquarters at Rye, N.Y. His territory includes all of New England, Westchester County, metropolitan New York, Long Island and northern New Jersey.

* *

OSCAR FROHMAN has been appointed general sales engineer for Ampco Metal, Inc., Milwaukee. JAMES ARTER has been named assistant general manager for the company.

* *

JOHN L. LANG, formerly superintendent of the chemical and metallurgical laboratories, New York Shipbuilding Corp., has joined the staff of Lukenweld, Inc. as welding engineer.

* *

ARTHUR E. BAYLEY has been appointed assistant treasurer of U.S. Steel Supply Co. and is located at the company's general headquarters, 1319 Wabansia Ave., Chicago.

* *

BRYCE GRAY, formerly city clerk of the borough of Longport, N.J., has joined the advertising department of the Pennsylvania Salt Mfg. Co.

* *

WILLIAM BURNETT, formerly with the Cadillac Motor Car Co., has joined the Ford Motor Co. as head of the newly-created experimental section of the company's engineering department.

* *

FRANCIS J. WAKEM has been appointed vice-president of Johns-Mansville Sales Corp. Mr. Wakem will continue as merchandise manager of the industrial products division.

* *

RAY A. OBRECHT has been named to head the new process engineering department of Progressive Welder Co., Detroit.

* *

E. T. CUDDEBACK is now representing the Allis-Chalmers Mfg. Co. at the firm's Atlanta, Ga., district office.

* *

ROBERT C. JUDD has been appointed market research manager for R. G. LeTourneau, Inc., Peoria, Ill.

* *

W. R. PERSONS has been appointed sales manager of the Lincoln Electric Co., Inc., Cleveland.

. . . for BETTER Welds
use BBB KEEN-ARC CARBONS

Designed to carry the high currents necessary for intense heat, BBB Keen-Arc Carbons produce a fine-grained weld of high tensile strength. They give a smooth, steady "flowing" flame which does not wander and which is concentrated at the desired focal point. Flame temperature is easily and accurately adjusted by merely changing the ampere input, and heavy copper coating permits gripping at extreme ends—eliminates frequent and periodic re-setting.

Write us for full facts on both Keen-Arc A. C., and Keen-Arc D. C., Carbons.

B·B·B Stands for Quality . . . KEEN-ARC CARBONS

BECKER BROTHERS CARBON CO. 3450 So. 52nd Ave. Cicero 50, Ill.

"FLUXINE" Fluxes are the result of over fifty years of scientific research into the metal-joining field. There are 89 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes cause no injurious fumes to irritate eyes or nose of the operator.

So confident are we that wherever a metal-joining operation is required FLUXINE Fluxes will do it better, faster, and more economically than any competitive fluxes, that we will be glad to have you try it at our expense.

Write on your company letterhead for a generous sample and directions for using FLUXINE Fluxes on 57 different metals.

Ask your jobber for Fluxine Fluxes . . . he knows the FLUXINE line produces the best results with the greatest economy.

KREMBS & COMPANY
Est. 1875
Dept. G, 669 W. Ohio St., Chicago 10, Ill.

FLUXINE
FLUXES TO JOIN ALL METALS
TRADE MARK REGISTERED U. S. PAT. OFF.

Off the Floor Deliveries!
ON
TRINDL SUPER INDUSTRIAL ARC WELDER
DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

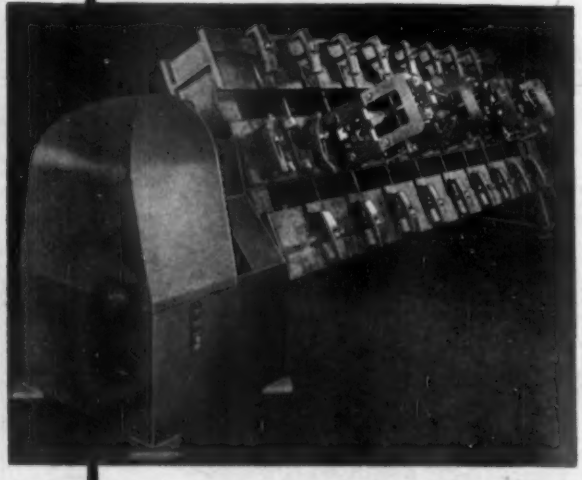
For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

TRINDL PRODUCTS, LTD. 11 EAST 23rd STREET AR CHICAGO 16, ILL.

Specially Engineered

FIXTURES and POSITIONERS for AUTOMATIC and HAND WELDING



THIS mammoth double-faced fixture with power positioning head is typical of the special production equipment designed and built by Bentley.

Write for information regarding practical production or job welding in your own plant.

BENTLEY WELDERY, Inc.
BOX 1038 SYRACUSE 1, N. Y.

OPPORTUNITIES FOR WELDING

(*continued from page 87*)

Miscellaneous—Including Eq'p't. Repairs & Hard-facing

Low Bidder

†**Arizona**—STRUCTURES, etc.—Bureau Reclamation, Yuma, Dec. 30, earthwork, mortar lining and structures, laterals from A and B Canals and completing farm deliveries from A Canal, Unit 1, Yuma Mesa Div., Gila Proj., Spec. 1546, from V. D. Case Co., 850 E. Ocean Blvd., Long Beach, Calif. $496,873.

Low Bidder

Calif., San Francisco—INNER TRACKS, etc.—Pub Utilities Comn., 287 City Hall, Dec. 10, reconstructing inner tracks on Market St. between Fremont and Eddy Sts., Spec. 253, from Charles L. Harney, 625 Market St. $183,266.

Low Bidder

★ †**Georgia and South Carolina**—DAM—U. S. Eng., P. O. Box 915, Augusta, Jan. 6, main section concrete dam for Clarks Hill Proj., from Morrison Knudsen Co., 319 Broadway, Boise, Idaho. $24,670,216. Est. $18,000,000.

Low Bidder

★ †**Mississippi**—U. S. Eng., P. O. Box 60, Vicksburg, constructing portion of Enid Dam Embankment, spillway and appurtenances on Yocona River, Yalobusha Co., from T. L. James, Inc. and Williams Brothers, Rushton, La. $5,431,472.

Low Bidder

†**New Mexico**—STRUCTURES, etc.—Bureau Reclamation, Tucumcari, Dec. 17, structures, lateral sys., Unit 2, earthwork, structures, Lateral Units 3 and 4, Conchas Canal, Station 3343 plus 17, to Station 3517 plus 70, Tucumcari Proj., Spec. 1531, from J. A. Terteling & Sons, 4011 Fairview Ave., Boise, Idaho, $875,759 on Schedules 1, 2, 3 and 4.

Low Bidder

★ **New York**—SWITCHBOARDS, etc.—Triborough Bridge & Tunnel Auth., at Engineer's Office Bldg., 10 State St., New York, Zone 4, mfg., del. electrical switchboards and panels with equip., appurtenances for Brooklyn-Battery Tunnel, from General Electric Co., River Rd., Schenectady. $990,912.

Contract Awarded

★ **N. Y., Brooklyn**—SIGNAL EQUIPMENT—Bd. Transportation, 250 Hudson St., New York, Zone 13, signal equip., Contr. S-45 Fulton St. Line, Pitkin Ave. Yard to Emerson-Garden Electric Co., Inc., and L. K. Comstock & Co., Inc., 155 E. 44 St., New York, Zone 17, $1,172,469.

Low Bidder

N. Y., New York—ESCALATOR EQUIPMENT—Bd. Transportation, 259 Hudson St., Zone 13, Dec. 20, removing, disposing passenger escalator equip. and furnishing, installing new passenger escalator equip., for Grand Central Station of Queensboro Line, IRT Div., Contr. E-56, from Otis Elevator Co., 260 11 Ave. $225,174.

[Low Bidder]

★ **N. Y., New York**—PLATFORM EXTENSIONS—Bd. Transportation, 250 Hudson St., Zone 13, Dec. 20, platform extens. of Lexington Ave. 4th Ave. Line, IRT Div., New York Transit Sys., Astor Pl., Spring and Bleeker Sts., from Poirer & McLane Corp., 33 W. 42 St. $1,834,340.

Contract Awarded

★ **N. Y., New York**—PLATFORM EXTENSIONS—Bd. Transportation, 250 Hudson St., Zone 13, platform extens. 23 to 28 and 33 Sts., Stations Lexington-4th Ave. Line, IRT Div., New York Transit System, to A. A. Johnson and Mason & Hangar, Inc., 500 5 Ave., Zone 18, $3,595,000.

Contract Awarded

O., Mount Vernon—TUNNELS—Dpt. Welfare, Columbus, tunnels, tunnel utilities and stub tunnels at Mount Vernon State Hospital, general contract to Ross Constr. Co., 412 Hartman Bldg., Columbus, $416,496; heating and plumbing, to Sauer Co., Inc., 368 N. Washington Ave., Columbus, $113,548. Forster, Wernert & Taylor, 735 Nicholas Bldg., Toledo, archts.

Low Bidder

Pa., Phila.—ELEVATED STATION—Phila. Dpt. City Transit, City Hall Annex, and Phila. Transportation Co., Mitten Bldg., Frankford Elevated line, (Highspeed) Margaret—Orthodox Station, constructing passenger loading platforms, track work, incl. steel, concrete, electrical

(*concluded bottom of page 113*)

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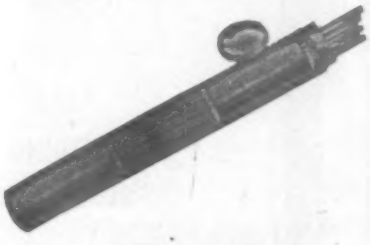

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POWDER CUTTING

(Continued from page 70)

iron ingot-mold foundry for the removal of lumps resulting from mold failure. In some cases the lumps require a cut 18 in. deep. The process permits reclamation of molds that would otherwise be considered scrap and offers attractive savings over removal of the lumps by chipping methods.

In the AISI listings of stainless steels, Type 310 contains the largest percentage of alloy content, about 45%. There are, however, numerous materials of higher alloy content that have the properties of extremely high corrosion resistance and high strength at high temperatures. These materials, including certain nickel-base alloys that contain up to over 75% of alloying elements, are being cut as a production operation. During the war, alloys for jet engines or gas turbines were successfully handled. On such alloys as these, the powder-flow requirements are higher and the cutting speeds somewhat lower than those obtained on equivalent thicknesses of 18-8 stainless steel.

Monel, Inconel and pure nickel itself have also been successfully cut, up to a maximum thickness of 5 in. Since the cutting action on these materials is primarily one of melting rather than oxidation, advantage is taken of the extremely high-temperature reaction between the powder and the cutting-oxygen stream. The quality of the cut surface is somewhat inferior to that on stainless steel.

To summarize, the use of a metallic powder provides a versatile process capable of handling a wide variety of alloy compositions from ingot form to finished product. By making it easier to produce and process these "hard-to-work" alloys, their use should expand considerably.

work, etc., from Golder Constr. Co., Market St., National Bank Bldg., lump sum $215,659. Est. $233,400.

CANADA

Contract Awarded

★ Alta., Spring Coulee—DAM—Prairie Farm Rehabilitation Admin., Regina, Sask., 185 ft. high dam in connection with St. Mary-Milk Rivers irrigation project, to W. C. Well Constr. Co., Ltd., Wilkie, Sask. $2,081,700.

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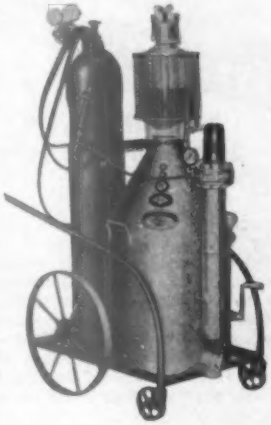

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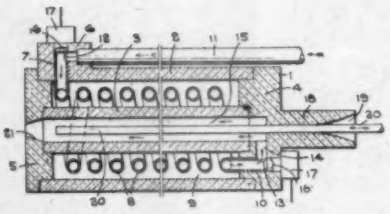

Induction Metal Spraying

2,411,409 William Edward Ballard, Harborne, Birmingham, England, assigned to Metallisation, Limited, Dudley, England. Filed August 22, 1944, in Great Britain Aug. 30, 1943. Issued November 19, 1946.

Apparatus for the melting and spraying of metal comprising an outer tubular housing and an inner tubular member having a nozzle at one end. The metal is fed into the inner tubular member, around which a tubular induction heating coil is disposed. Cooling gas under pressure is conducted forwardly through the inner tubular member.

* *

Helmet Window

2,411,224 Joe O'Reilly, Tacoma, Wash., assigned to Welding Service Sales, Inc., San Francisco. Filed June 19, 1943 and Sept. 2, 1944. Issued November 19, 1946.

In a window for welding helmets, having an inwardly extending flange and a transparent panel removably applied in the frame and seated against the flange. A clip is applied within the frame opening to retain the panel in place; clip comprises a cross member extending across the frame opening and opposite end legs pivoted at their ends to allow the clip to be swung outwardly from the panel for its removal. The cross member of the clip can be removably engaged with a lug on the frame back to hold the opposite end legs of the clip pressed against the panel and the panel seated in place.

* *

Electrode Holder

2,410,164 Honel A. Jackson, Detroit. Filed February 4, 1944. Issued October 29, 1946.

An electrode holder comprising an electrically conducting head, an insulating cover surrounding the head and a socket to receive the end of an electrode. The insulating cover has an opening through which the end of the electrode is passed into the socket. A pin of insulating material passes through cooperating openings in the head and insulation to lock the insulating cover on the head.

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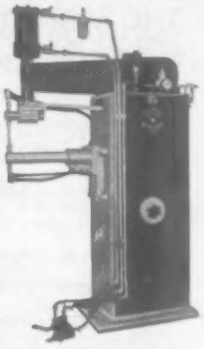

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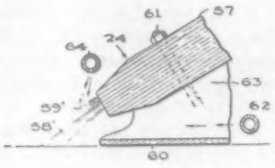
Nickel-Chrome Electrode

2,408,620 Erwin Felix Friedlander, Hobart, Tasmania, Australia, assigned to O. & F. Company Proprietary Ltd., Hobart, Tasmania, Australia. Filed November 20, 1943, in Australia, Nov. 20, 1943. Issued Oct. 1, 1946.

An arc-welding electrode for welding chromium or austenitic chromium-nickel alloy steels, such as stainless steels and the like. It comprises a core wire of low-carbon steel and a heavy coating of a diameter at least 1.5 times the diameter of the core wire. Coating contains the following ingredients: 15-30% nickel, 20–60% chromium, 4–10% ferro-silicon, 4–10% ferro-manganese and 3–8% ferro-molybdenum, with additional gas-forming and slag-forming ingredients. The nickel and chromium combine under the heat of the arc with the metal of the core wire to deposit a chromium-nickel alloy steel. The slag-forming ingredients produce a slag which protects the molten metal while it is passing through the arc and covers the deposit until the weld has solidified.

* *



Torch Scarfing Method

2,409,654 James L. Anderson, Closter, N. J., assigned to Air Reduction Company, Inc., New York City. Filed October 30, 1941. Issued October 22, 1946.

A method of scarfing a surface of a billet by means of a scarfing torch. This comprises directing crosswise against such surface a row of oxygen streams, causing relative movement of the oxygen streams and workpiece, and in the direction of the latter, directing preheating flames downwardly at an angle, but from above the oxygen streams, blowing a stream of air between the torch and the workpiece toward the oxygen streams, and aiding combustion of the preheating flames by blowing other streams of air downwardly toward and onto the preheating flames prior to contact of the latter flames with the work.

* *

Flash-Welding Control

2,412,067. Clyde E. Smith, Warren, O., assigned to The Taylor-Winfield Corp., Warren. Filed May 19, 1946. Issued December 3, 1946.

A control circuit and timer for flash-welding apparatus having movable platens and a circuit to conduct current to workpieces held in them. The patent covers the combination of timing means, means to initiate operation of timing upon completion of the flashing period and substantially at the time of movement of the workpieces into engagement with each other at the start of upsetting and a means controlled by timing means to interrupt conduction in the circuit.

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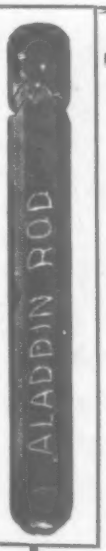

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Device for Soldering Irons

2,411,549 Le Roy John Lindberg, Wanamassa, N. J. Filed March 3, 1945. Issued November 26, 1946.

A transformer mounted on an apertured baseboard and having in its secondary circuit a pair of electrodes complementary to the tip portion of a soldering iron. A normally-open switch forming a part of the primary circuit of the transformer is also mounted on the baseboard about the apertured area. A leaf spring is fixed to the lower side of the baseboard, having a downwardly converging portion disposed under the apertured area. A plunger is slidably positioned through the apertured area. Insertion of a soldering iron into the electrodes will cause relative movement of the baseboard and spring, thereby moving the plunger upwardly to close the normally-open switch and complete the primary circuit of the transformer.

* *

Industrial Eyeshield

2,409,140 Robert L. Malcom, Chicago, Ill., assigned to Chicago Eye Shield Company, Chicago. Filed April 29, 1944. Issued October 8, 1946.

An industrial eye shield with a resilient plastic frame having a frontal section with lens-receiving openings. A plurality of inner ledges extend toward each other on the inside of the frame. Around each lens-receiving opening are also a plurality of outer projections extending toward each other on the outside of the frame. The outer projections are adapted to maintain the lens in locked position in each opening, in abutting relation against the inner ledges. The Frame is flexed so that the lens can be sprung into the opening and positioned there.

* *

Welding Transformer

2,411,921 Harry E. Kennedy, Berkeley, Calif., assigned to The Linde Air Products Co., New York City. Filed Feb. 1, 1944. Issued Dec. 3, 1946.

In a constant-current transformer having both a fixed and a movable coil, a pressure-responsive actuating device operatively associated with the movable coil. The movable coil is maintained, against the force of gravity, in a desired position by the sum of the forecs of the preasure applied to the device and of the magnetic repulsion between the coils.

* *

Goggles

2,411,933 Charles E. Morley and Harold S. Davis, Detroit. Filed May 27, 1943. Issued Dec. 3, 1946.

In protective goggles a pair of cup-shaped lens-holding frames and projections extending laterally in overlapping relationship. The projections have horizontally elongated intermeshing serrations which enable adjustment of the frames toward and away from each other. There is also a means for clamping the overlapping projections in any one of several positions.

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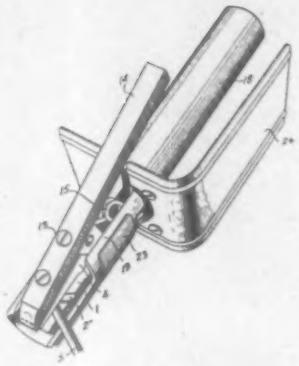

Electrode Holder

2,411,980 CLARENCE RINGWALD, Springfield, Ohio. Filed Sept. 25, 1943. Issued Dec. 3, 1946.

An electrode holder with an integral clamp jaw at one end and a detachable coupling for an electric cable at the other end. A spring-actuated complementary clamp jaw is pivoted to the main member and a housing of insulating material encloses both member and clamp jaws. The insulation has a cutaway portion that affords access to one side of the clamp jaws and a portion of the housing at the opposite side of the jaws affords a limiting stop for the end of a welding electrode.

* *

R-W Pressure Control

2,412,044 HANS H. HANSEN, Warren, O., assigned to The TAYLOR-WINFIELD CORP., Warren, O. Filed April 13, 1944. Issued Dec. 3, 1946.

In resistance-welding apparatus, means to apply pressure comprising in combination a welding electrode support, a movable disklike wall rigidly connected to the support, a housing enclosing the wall and flexible diaphragm rings. The housing is movable with respect to the wall in a direction toward and away from the welding electrodes. The flexible ring has its outer edge secured to the side wall of the housing and its inner edge secured to the wall to define an expansible pressure chamber immediately above the wall. A second diaphragm ring has its outer edge secured to the wall and its inner edge secured to the bottom wall of the housing to define a second pressure chamber immediately below the wall. The welding pressure applied is the resultant of the opposing pressures exerted by the fluid pressures in the two pressure chambers.

* *

Insulation Stud

2,412,744. TED NELSON, San Leandro, Calif. Filed July 24, 1944. Issued December 17, 1946.

A metal lath stud comprising a body, a shoulder, a bendable shank extending from the shoulder and a separate head to seat on the shoulder. The latter head has an aperture through which the shank passes to provide a tip over which the metal lath may be passed to lie against the head.

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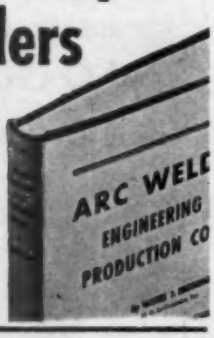

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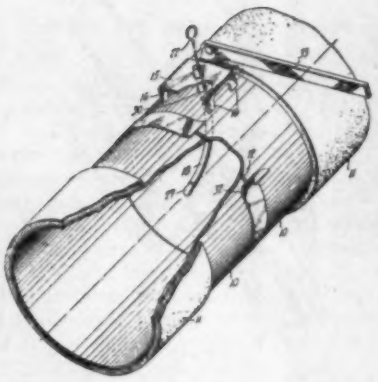


Radium Inspection Method

2,412,174 RUSSELL G. RHOADES, San Francisco, assigned to BECHTEL BROTHERS McCONE Co. Filed June 24, 1946. Issued Dec. 3, 1946.

A method of radiographing a circumferential weld in a pipe line when access from an open end is impracticable. A temporary opening in the wall of the pipe is made at a point adjacent to the weld, and radioactive material introduced through this opening. The radioactive material is positioned in the general plane of the weld and substantially on the axis of the pipe line. After the film wrapped around the pipe has been exposed to the emanations of the radioactive material, the latter is withdrawn through the temporary opening which is then sealed.

* *

Patents Available for Licensing or Sale

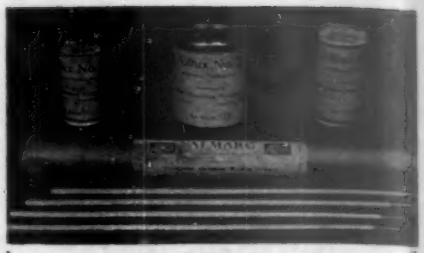
1,899,064. Manufacture of Electrodes. Issued Feb. 28, 1933. Method for making electrodes of good conductivity from pulverized graphite and a binder. Eliminates the baking process. The electrodes are useful as anodes in electrochemical processes and particularly for the production at low cost of oxide of carbon. (Owner) BURGESS BATTERY CO., BATTERY DIV., Freeport, Ill.

* *

2,090,846. Soldering Flux. Issued Aug. 24, 1937. A soldering flux of the water-insoluble type made by the interaction of organic materials, such as resins, and stannic chloride. The flux so made is non-corrosive at ordinary temperatures and is very active at soldering temperatures. (Owner) BURGESS BATTERY CO., BATTERY DIV., Freeport, Ill.

* *

2,390,890. Method of Soldering. Issued Dec. 11, 1945. This method makes it possible to solder with metals, such as lead, ordinarily used with difficulty for this purpose. A composite soldering strip is made in which the solder metal is provided with a metallic backing element having a much smaller cross-sectional area and a much higher melting point than the solder. A specified technique is required when this soldering element is used. (Owner) BURGESS BATTERY CO., BATTERY DIV., Freeport, Ill.



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